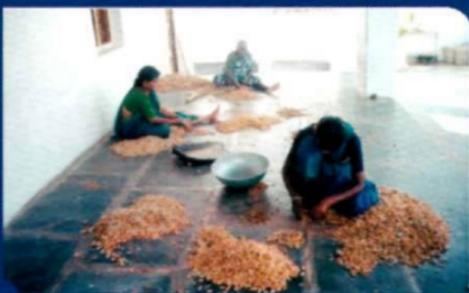


## Farmers' participatory management of diseases for higher yield and nutritive value of crop residues of groundnut, Deccan Plateau, India



**Citation:** Pande S, Sreenivas B, Parthasarathy Rao P, Narayana Rao J and Lakshmi Reddy P (eds.). 2006. Farmers' participatory management of diseases for higher yield and nutritive value of crop residues of groundnut, Deccan Plateau, India. Proceedings of a workshop, 3-4 January 2005, ARS, ANGRAU, Rekulakunta, Anantapur, Andhra Pradesh. Patancheru, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics. 168 pp. ISBN 92-9066-485-1. Order code CPE 157.

# Farmers' participatory management of diseases for higher yield and nutritive value of crop residues of groundnut, Deccan Plateau, India

*Proceedings of a workshop*

**3-4 January 2005**

**ARS, ANGRAU, Rekulakunta, Anantapur,  
Andhra Pradesh**

*Organized jointly by*

**ANGRAU - ICRISAT - ILRI**

*Funded by*

**DFID - CPP and LPP, UK**

*Edited by*

**S Pande, B Sreenivas, P Parthasarathy Rao,  
J Narayana Rao and P Lakshmi Reddy**



**ICRISAT**

**International Crops Research Institute  
for the Semi-Arid Tropics  
Patancheru 502 324  
Andhra Pradesh, India**



**International Livestock Research Institute  
Patancheru 502 324  
Andhra Pradesh, India**



**Acharya NG Ranga Agricultural University  
Rajendranagar, Hyderabad 500 030  
Andhra Pradesh, India**

**DFID** Department for  
International  
Development



## About the editors

- S Pande Principal Scientist (Pathology), ICRISAT, Patancheru, Andhra Pradesh, India.  
Email: s.pande@cgiar.org
- B Sreenivas Former Chief Scientist, ARS, ANGRAU, Anantapur. Presently Consultant, AMRARD, Rajendranagar, Hyderabad, Andhra Pradesh, India.  
Email: sburra@tatanova.com
- P Parthasarathy Rao Senior Scientist (Socioeconomics), ICRISAT, Patancheru, Andhra Pradesh, India.  
Email: p.partha@cgiar.org
- J Narayana Rao Senior Scientific Officer (Pathology), ICRISAT, Patancheru, Andhra Pradesh, India.  
Email: jnrao@cgiar.org
- P Lakshmi Reddy Senior Scientist (Pathology) and Coordinator, DAATTC, ANGRAU, Anantapur, Andhra Pradesh, India.  
Email: plreddy\_2003@rediffmail.com

# Contents

---

Foreword .....	vii
Acknowledgments .....	viii
<b>Inaugural session</b> .....	<b>1</b>
Welcome address .....	3
<i>CLL Gowda</i>	
Welcome address .....	6
<i>A Satyanarayana</i>	
Welcome address .....	8
<i>YV Malla Reddy</i>	
Background and objectives of the project .....	10
<i>S Pande</i>	
Genesis of participatory IDM technology in ICGV 91114, a dual purpose, short duration, high yielding groundnut cultivar in Anantapur, India .....	12
<i>B Sreenivas, S Pande and J Narayana Rao</i>	
Crop-livestock linkages: A case study of improved groundnut cultivars in the Deccan Plateau .....	18
<i>P Parthasarathy Rao and V Shravan Kumar</i>	
<b>Session I: Integrated crop and pest management in groundnut</b> .....	<b>25</b>
Improved crop husbandry practices in groundnut in dryland agriculture: Need and scope .....	27
<i>T Yellamanda Reddy</i>	
Integrated management of groundnut fungal diseases .....	37
<i>S Pande, G Krishna Kishore and J Narayana Rao</i>	
Groundnut diseases and their management .....	45
<i>K Subrahmanyam</i>	
Groundnut aflatoxin and its management .....	48
<i>Farid Waliyar and S Veera Reddy</i>	
Groundnut insect pests and their management .....	52
<i>NC Venkateswarlu</i>	

<b>Session II : Farmers' participatory on-farm Integrated Disease Management in groundnut</b> .....	55
Influence of IDM on groundnut yields in the Deccan Plateau, Andhra Pradesh .....	57
<i>S Pande, J Narayana Rao, P Lakshmi Reddy and G Krishna Kishore</i>	
Farmers' participatory crop and disease management in groundnut in Anantapur .....	67
<i>P Lakshmi Reddy and K Ankaiah Kumar</i>	
On-farm Integrated Disease Management in groundnut and upscaling of dual purpose, short duration groundnut genotype ICGV 91114 .....	70
<i>KA Karim and B Raghu Rami Reddy</i>	
On-farm Integrated Disease Management for groundnut in Kadiri: Constraints and opportunities .....	73
<i>Y Ramesh</i>	
Farmers' participatory crop and disease management in the Deccan Plateau: NATP experiences .....	75
<i>Suseelendra Desai</i>	
Groundnut crop management practices: Farmers' perceptions .....	84
<b>Session III : Diseased haulm, yield, nutrition and digestibility</b> .....	87
Effect of diseased groundnut and sorghum crop residues on nutrient utilization in cattle .....	89
<i>Y Ramana Reddy, K Sivaiah, T Janardhana Reddy, S Pande and M Blummel</i>	
Stover quality of crop residues: Groundnut and sorghum .....	95
<i>M Blummel, P Parthasarathy Rao, S Pande and BVS Reddy</i>	
Feeding diseased vs healthy groundnut haulms: Farmers' perceptions ...	98
Findings from on-farm participatory rural appraisals: The ILRI experience .....	99
<i>G Venkata Rami Reddy</i>	
<b>Session IV: Harvest management and marketing of pod and fodder (haulms) in groundnut</b> .....	101
Management of harvesting in groundnut .....	103
<i>S Vasundhara</i>	

The present marketing system for groundnut: Constraints and opportunities. ....	104
<i>V Reddappa Reddy</i>	
Marketing groundnut pods and fodder: Farmers' perceptions .....	106
<b>Session V: Linkages and seed systems</b> .....	107
Sorghum for mixed crop-livestock systems in the Deccan Plateau .....	109
<i>BVS Reddy</i>	
Seeds of choice for sustainable agriculture .....	115
<i>B Sreenivas</i>	
Village level seed system in groundnut: Constraints and opportunities .....	117
<i>A Satyanarayana</i>	
The existing seed system at the village level: Farmers' perceptions .....	120
<b>Recommendations</b> .....	121
<b>Invitees and participants</b> .....	125
Appendix (Anubandhamu = అనుబంధము) .....	131



# Foreword

---

Groundnut (*Arachis hypogaea* L.) is one of the most important oilseed crops in the rainfed areas of the Deccan Plateau in India, providing nutritious fodder for ruminants. For several decades, farmers in this region have been cultivating the traditional cultivar TMV 2. However, they have been plagued by economically significant foliar diseases like late leaf spot (*Phaeoisariopsis personata*) and rust (*Puccinia arachidis*), leading to low and poor pod and fodder yields.

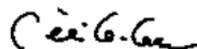
For the past decade, the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), in collaboration with partner organizations, has been striving to develop and promote sustainable management technology options to manage these diseases in groundnut and achieve higher pod and fodder yields at the farm level. Following several on-station and on-farm studies, a dual purpose, early-maturing groundnut cultivar ICGV 91114 and its Integrated Disease Management (IDM) technology were developed at ICRISAT as a substitute for TMV 2. The package includes the economical use of fungicide as seed treatment and foliar application.

The objectives of this workshop, *Farmers' participatory management of diseases for higher yield and nutritive value of crop residues of groundnut, Deccan Plateau, India*, are to critically review the results of the studies conducted over the last two years and ascertain how to make best use of the findings. Held at the Agricultural Research Station (ARS), Acharya NG Ranga Agricultural University (ANGRAU), Anantapur, Andhra Pradesh, the workshop was sponsored by ICRISAT, the International Livestock Research Institute (ILRI), ANGRAU, and funded by the Department for International Development (DFID), UK.

ICRISAT is a firm believer that farmers are partners in progress. Participating in these discussions were farmers/farmer representatives, fodder traders, village-level veterinarians, extension specialists, NGOs, and natural and social scientists. The specific objectives of the final workshop of stakeholders were to synthesize results, finalize recommendations and discuss the need and form of further research.

This proceedings elucidates on farmers' participatory IDM and its components, such as the management-responsive early-maturing groundnut cultivar (ICGV 91114) and need-based minimal use of fungicides. It also traces the genesis, evaluation and eventual promotion of IDM in farmers' participatory approach. Its potential economic benefits and impact in groundnut-growing areas of the Deccan Plateau are also outlined, making it clear that the dual-purpose ICGV 91114 can successfully replace local cultivar TMV 2.

I am sure that the IDM technology will enhance crop yields and the nutritive value of crop residues, thus improving the livelihood of farmers engaged in the mixed crop-livestock system. The efforts in promoting the technology for more pods, haulms and milk to benefit groundnut farmers in the Deccan Plateau are indeed laudable.



William D Dar  
Director General, ICRISAT

# Acknowledgments

---

The authors are grateful to the United Kingdom's Department for International Development (DFID), and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). We gratefully acknowledge the support of Dr M Blummel, Animal Nutritionist, International Livestock Research Institute (ILRI) based at ICRISAT, and Dr Farid Waliyar, Advisor to the DG and Principal Scientist (Pathology), ICRISAT for providing active support and participation in the project. We acknowledge Drs CLL Gowda, Global Theme Leader - Crop Improvement, HC Sharma, Special Project Scientist (Entomology) and Belum VS Reddy, Special Project Scientist (Breeding) for their cooperation and contribution provided to the project activities.

Our grateful thanks to the scientists and field staff of the Agricultural Research Station (ARS) of the Acharya NG Ranga Agricultural University (ANGRAU), Rural Development Trust (RDT), Legumes Pathology unit of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Agricultural Man Ecology (AME) and its network of NGOs for their cooperation and committed work.

We remain thankful to farmers who participated in this on-farm research.

We thank Ms Sheetal Vyas, for editing these proceedings and finally, Mr TR Kapoor and Ms Lydia Flynn, for coordinating the production process.

# Inaugural session

---



# Welcome address

---

**CLL Gowda<sup>1</sup>**

On behalf of the International Crops Research Institute for Semi-Arid Tropics and the International Livestock Research Institute, I would like to welcome you to this Stakeholders' Workshop, *Farmers' participatory management of diseases for higher yield and nutritive value of crop residues of groundnut, Deccan Plateau, India*, funded by the United Kingdom's Department for International Development (DFID). The workshop has been jointly organized by ICRISAT, Acharya NG Ranga Agricultural University (ANGRAU) and ILRI-Asia Unit based at ICRISAT, Patancheru.

Collaboration between ICRISAT and ANGRAU dates back to the 1970s when ICRISAT came to Andhra Pradesh, India. Our association with ANGRAU added several dimensions to our portfolio of research and developmental activities across our Global Themes, especially to the Global Themes on 'Crop improvement, management and utilization for food security and health', and 'Land, water and agro-diversity management - agroecosystem development'.

India has the largest population of ruminants in South Asia and livestock production forms an integral part of an age-old system of mixed farming. However, in recent times specialized peri-urban dairy farming has been developed by the landless in many areas. Feed resources are brought daily into peri-urban areas from the surrounding rural areas. Projected increase in human population in South Asia, particularly in India, and higher per capita income over the next 25 years is expected to stimulate significant consumption of bovine products such as milk. The 'livestock revolution' will provide opportunities for increased production and improved livelihood, provided the constraints are overruled. One of the most important technical constraints in animal production is inadequate supply of high quality feed throughout the year. As progressive shrinkage of natural pastures continues with increased cultivation, the dependence on crop residues and agro-industrial by-products as feed resources will continue to increase.

The major crop residues that are used as fodder come from cereals and pulses. On the Deccan Plateau, in India, sorghum and groundnuts are major sources of such fodder. Sale of cereal crop residues to peri-urban producers accounts for more than 50% of income derived from cropping. Large areas of dual-purpose cultivars of sorghum are grown on the plateau. These cultivars

---

<sup>1</sup> Global Theme Leader, Crop Improvement, ICRISAT, Patancheru, Andhra Pradesh, India.

that provide both grain and straw for animal feed are important for farmers who care about fodder yields as much as they do about grain yields. The increasing importance of sorghum straw is reflected in its market price, which in parts of India has been increasing relative to the price of grain. Groundnut is also an important oilseed crop in the Deccan Plateau. In this region alone, it accounts for more than 21 % of the total production in India. Although groundnut crop residues are a major roughage source for dairy animals here, their nutritive value is low.

If ruminant productivity is to be increased to meet new demands for milk, then the availability of higher quality crop residues will be a critical factor. Improving yield and feeding value of crop residues will increase the availability of nutrients to ruminants, help alleviate animal feed deficits and enhance the benefits resulting from the complementarities between crop and livestock systems.

It is against this background that the current project has been conceived. Traditional dual-purpose sorghum cultivars are susceptible to foliar and stalk diseases, while commonly grown groundnut cultivars are susceptible to foliar diseases. The quantity and nutritive value of their residues are also likely to be affected by these diseases. In many ways, the project is unique. Two DFID research programs fund the project and one program (Crop Protection Program) does not have a history of involvement in livestock-related work. Plant, animal and social scientists have participated in various studies in a truly multi-disciplinary manner. The research is novel. The effects of pathogenic microorganisms on grain yields are well documented, but effects on biomass yield and nutritive value are rarely recorded. Activities have involved not only *in vitro* studies of nutritive value in the laboratory, but also *in vivo* assessment in both buffalo and cattle. In addition to two international agricultural research centers, the work has involved farmers (both men and women), village level farmer organizations, national agricultural research institutes (NARS) and non-government organizations (NGOs), and provided training opportunities for postgraduate students.

During phase 1 of the project (1999-2002), the component studies generated a wealth of important data. Information has been collected from on-farm surveys of disease incidence in three states of India, even as perceptions of farmers and fodder traders regarding the effects of diseases have been solicited. On-station trials have been conducted to quantify disease effects and their mitigation through management practices. Finally, indoor animal feeding trials have been undertaken to measure the effects of diseases on digestibility and voluntary intake in buffalo and cattle.

Impressed by achievements and successes of the first phase of the project, DFID decided to further fund this project for another two years (2003-2005) with the main goal of further validating and expanding the improved

technologies to grow healthy sorghum and groundnut crops and their residues. Another important goal of the project is to establish village level seed systems for the multiplication and distribution of dual-purpose and management responsive high yielding (both pod and haulm) groundnut varieties in the mixed crop-livestock systems.

Accordingly, the purpose of this stakeholders' workshop is to critically review the results of studies conducted over the last two years; and to consider the opportunities for an extension of the project to examine the effects of diseases on milk production, quality, human health and sustainable livelihoods. I welcome participatory farmers, natural and social scientists, representatives of ANGRAU, the two international centers, NGOs, farmers and fodder merchants to this two-day workshop.

# Welcome address

---

## A Satyanarayana<sup>1</sup>

On behalf of the Acharya NG Ranga Agriculture University (ANGRAU), I extend a warm welcome to all scientists from ICRISAT, Central Research Institute for Dryland Agriculture (CRIDA), the Department of Agriculture, and to all the farmers and journalists who have graced our research center today.

Farmers who raise rainfed crops in dryland agriculture give as much importance to livestock as they do to agriculture. Home dairying, sheep and goat rearing are alternate livelihoods during the summer if they are to have a stable supplementary income. Therefore, dual-purpose crops that produce food grains as well as fodder have acquired importance, and are grown widely in the Deccan area. Of late, however, dual-purpose crops are being replaced by commercial crops and as a result, there is an acute shortage of fodder. This in turn leads to distress sale of cattle by farmers. This shortage of fodder is felt more acutely during drought years.

In the current scenario, traditional types of cultivation with bullocks are gradually being forgotten, cattle rearing is becoming rarer and agriculture is being mechanized to an even greater degree. As you all know, there is a remarkable difference in sustaining soil fertility with and without cattle manure. An example to demonstrate how handicapped we are without bullocks: when there is continuous rain on black soils, the field does not dry quickly. This usually results in vigorous growth of weeds. Unless the soil is worked out, it won't dry and the crop does not get aerated and turns green. A farmer with bullocks would be able to take rapid action, but without them, he would have to rely on someone else's cattle to be available on hire. I do not suggest that we not mechanize agriculture; I only recommend that we conjunctively use bullocks also. Cattle and crops go together, indeed they are complementary to each other. I always especially tell small farmers that they should own cattle so they can have farmyard manure available to their fields. The soil becomes fertile and its physical structure improves; it can retain more moisture and salinity decreases. Farmers often express their inability to maintain cattle in the absence of fodder. We come to a full circle: with an increase in dual-purpose crops, livestock populations would also increase and stabilize, thus leading to greater sustainability in agriculture. Women and children can work with dairy animals and supplement their agricultural income.

---

<sup>1</sup> Director of Extension, ANGRAU, Hyderabad, Andhra Pradesh, India.

During this workshop, we discuss several important issues: Groundnut which gives pods as well as nutritious haulms; the possibilities of Jowar, another dual purpose crop; excessive use of pesticides, their effect on crop residues and the health of cattle; the effects of chemical residues through the food chain to humans and ensuing health problems. This project, initiated by ICRISAT in collaboration with other allied organizations and farmers, aims at improving the quality of the haulms by choosing disease resistant varieties of crops, especially groundnut, and following Integrated Disease Management (IDM) practices. During this workshop, ICRISAT and partners (including farmers) will take stock of the work done on IDM technologies in groundnut, and suggest areas for future research and development in groundnut and other dual-purpose crops that can be grown profitably in the Deccan Plateau.

# Welcome address

---

**YV Malla Reddy<sup>1</sup>**

I welcome all participants from ANGRAU, CRIDA, SK University and farmers. I believe this workshop has great relevance in the present scenario of dryland agriculture in Anantapur. Groundnut is the major crop here, useful to human beings as well as cattle; and as such, it is quite appropriate to discuss it in detail. I will give a brief account of the work Rural Development Trust (RDT) is doing, by touching on three or four issues we have taken up.

Soil conservation is one of our main programs. So far, this has been undertaken in roughly 10% of the district, ie, 0.1 m hectares. We adopt a participatory mode, working in conjunction with farmers. Participation was sought in two areas: contour bunding and financial contributions. Our experiences in the first type were revealing. At first, we created the contour bunds scientifically without involving farmers at all. As they did not understand the concept, over time, they started to plough away the bunds. Then the benefits that accrue from contour bunding were clearly explained, and farmers' opinions sought. This led to a very effective interaction. In the second type of participation, farmers paid 10 to 30% of expenditure incurred for works undertaken in their area. This demonstrates their understanding of the importance of the work being carried out.

Our second program is rainwater harvesting. Contour bunds perform the first task of stopping rainwater. Beyond this, lies necessary maintenance of traditional water harvesting structures such as tanks, ponds, check dams. We are happy to report that about 1500 such repairs have been completed by us; even here, farmers contributed 5-10% of estimated costs, which is an unmistakable indication of their active participation.

Our third program is horticulture under rainfed conditions. Orchards are usually grown where irrigation facilities are available. In this drought prone area, we are trying to establish mango, tamarind and sapota orchards with protective irrigation for the first two years by hand watering. Supportive irrigation to these saplings was done either through tankers or through pot watering from ponds and tanks. RDT also gives financial assistance initially for three years for the maintenance of these crops. Like the government of Andhra Pradesh, we also supplied seedlings free of cost or at subsidized rates.

Dairy and orchards are very essential in Anantapur if sustainable incomes in agriculture are to be achieved. Once they are established, trees like mango or

---

<sup>1</sup> Executive Director, AF/RDT, Anantapur, Andhra Pradesh, India.

sapota can withstand drought conditions, and can survive continuous dry spells for 50 to 60 days. Farmers have shown much enthusiasm for horticulture in the district.

Extension education on-site is another of our programs. Agricultural research stations, ie, scientists, bring out certain effective research findings such as the correct rate of seed and fertilizer to be used, methods of intercropping and laying dead furrows. RDT organizes campaigns to spread these messages in the farming community through brochures, pamphlets etc. We have been receiving good feedback on this - farmers have benefited from this and have been able to obtain 10 to 20% better yields from their crops even in drought years.

We also take part in on-farm research activities. For example, RDT is a partner in ICRISAT's IDM research project and 'on-farm' research activities. We have encouraged farmers to sow new varieties of groundnut in their fields, and also help with crop monitoring, recording yield and other important economic parameters of each variety. Likewise, we also work with scientists of the Agricultural Research Station, Anantapur; on the water innovation project which helps study new ways to counter scarcity of fodder.

I hope that such effective collaborations between research institutions, NGOs and the farming community continue and reach greater benefits to the poor.

# Background and objectives of the project

---

S Pande<sup>1</sup>

The project *Evaluation of plant diseases on crop residues in India* funded by DFID has two phases. In Phase I from 1999 to 2002, we quantified the effect of diseases on yield and nutritive value of crop residues in groundnut and sorghum. During this phase, we developed improved integrated foliar disease management (IDM) technology to manage foliar diseases in groundnut. During Phase II, from 2003 to 2005, IDM technology, along with dual-purpose groundnut varieties, was evaluated, validated and promoted through farmers' participatory mode in villages in the Deccan Plateau, India.

The principal crop residues used as fodder are those from cereals followed by pulses. It is estimated that the potential availability of residues in India includes 75 million tons from coarse grains (sorghum, etc.) and 39 million tons from legumes (mainly from groundnut). On the Deccan Plateau, in the state of Andhra Pradesh alone, groundnut is the second major source of residues (after sorghum) comprising 14 million tons as feed for livestock.

Groundnut crop residue (fodder) from farmers' local cultivars in the Deccan Plateau is low in protein and digestibility. If the quality of crop residues is improved, as well as its nutritive value, it will meet the new demands of milk. Improving nutritive value increases nutrient availability, alleviates feed deficits and enhances benefits from crop-livestock complementarities.

In this project, the main focus is management of diseases to improve quality of crop residues. In Phase I, we noticed that diseases affect quality and quantity of crop residues. Diseased residues command lower prices. High quality and quantity of residues increase farm incomes of resource-poor farmers in this region.

Farmers also perceive that diseases reduce the quality. Hence, fodder quality is important for the poor in rural populations, as it constitutes the main source of feed for their cattle. They also depend on the sale of fodder as a source of additional income. Poor and middle class farmers are dependent on milk and a loss with fodder combined with inferior quality costs them dearly. Therefore, there is a need to improve the quantity and quality of the groundnut crop and its residues for the sustainability of the mixed crop-livestock system.

---

<sup>1</sup> Principal Scientist (Pathology), ICRISAT, Patancheru, Andhra Pradesh, India.

In Phase II of the project, it has been decided to work in partnership with farmers through our active collaborators. The specific objectives of this phase are to:

- Refine, validate and scale-up IDM practices in groundnut
- Multiply and distribute dual purpose groundnut varieties that are responsive to management
- Use crop residues of improved varieties in milk production trials with dairy animals
- Quantify losses and gains at farm level in varietal adoption and milk production
- Establish village level seed systems

We have achieved most of these objectives. What we seek to do now is review critically farmers' responses in this stakeholders' meet. We will identify areas that need correction and explore opportunities for further extension.

# Genesis of participatory IDM technology in ICGV 91114, a dual purpose, short duration, high yielding groundnut cultivar in Anantapur, India

---

**B Sreenivas<sup>1</sup>, S Pande<sup>2</sup> and J Narayana Rao<sup>3</sup>**

Anantapur district in western Andhra Pradesh lies between 13° - 41' and 15° - 14' North latitude and 76° - 47' and 78° - 26' East longitude. It is bounded on the north by Bellary and Kurnool districts, on the east by Kadapa and Chittoor and on the south and west by Karnataka state. It forms part of the northern extremity of the Deccan Plateau and slopes from south to north. Its elevation towards the south is 2200' mean sea level (MSL) while it gradually comes down to 1000' in the north and 900' in the northeast. The area towards the eastern side is hilly with rolling topography.

The total geographical area is 1917000 ha with a total population of 3639000 with a density rate of 190 per square kilometer. Nearly 68% of its people are dependent on agriculture. In Andhra Pradesh, the district ranks third in area and eleventh in population. Geographically, Anantapur can be grouped into three natural divisions: (i) Gooty, Tadipatri and Urava Konda in the North with large areas of black cotton soils (vertisols); (ii) Anantapur, Kalyandurga, Rayadurg, Dharmavaram, Kadiri and Penukonda in the center with their arid, treeless expanses and poor soils, and (iii) Hindupur and Madakasira in the south, with their comparatively less hospitable soils. The terrain of Anantapur is undulating and the soils for the most part are red sandy loams; low in ion exchange capacity, water holding capacity and poor in fertility status.

The major cropping systems under rainfed agriculture are groundnut/pigeonpea or groundnut/castor. Occasionally other crops like bajra, jowar and sunflower are intercropped with groundnut. The total area under groundnut is about 0.8 m ha, with a total production of 363000 tons - the highest in the state. But unfortunately productivity is low: merely 0.5 t/ha. The general problems facing crop production in these areas are:

- Non-availability of improved varieties of groundnut seed
- Poor crop stands due to crusting, rapid drying of surface soil and high soil temperatures

---

<sup>1</sup> Former Chief Scientist, ARS, ANGRAU, Anantapur. Presently Consultant, AMRARD, Rajendranagar, Hyderabad, Andhra Pradesh, India.

<sup>2</sup> Principal Scientist (Pathology), ICRISAT, Patancheru, Andhra Pradesh, India.

<sup>3</sup> Senior Scientific Officer (Pathology), ICRISAT, Patancheru, Andhra Pradesh, India.

- Poor crop growth due to unreliable soil moisture, low soil fertility, difficult soil tillage and compact subsoil layer (argillic horizons)
- Poor yields due to biotic constraints, mainly foliar diseases

Late leaf spot, rust, collar rot, stem rot, bud necrosis are among the biotic constraints for groundnut production, economically. Late leaf spot (*Phaeoisariopsis personata*) and rust (*Puccinia arachidis*), together called 'tikka' disease are the most destructive and cause pod and fodder losses upto 70% every year when farmers' local cultivar (TMV 2) is used in this district. Farmers also suffer severe losses by indiscriminate use of hazardous chemicals while trying to control these foliar diseases.

Despite good intentions, the distance between phytopathologists and farmers remains wide and is even greater in backward areas such as Anantapur. To narrow the gap between technology generation, technology transfer and technology adoption subsystems, there is an urgent need to initiate on-farm evaluation of groundnut foliar disease management technologies to boost groundnut productivity both in pod and haulms. Haulms are of considerable economic importance as nutritious fodder for cattle in the case of both draught and milch animals.

Complete reliance on host plant resistance has not been a successful approach as such groundnut varieties were not available to farmers. Since 1995, efforts have been made to manage foliar diseases by adopting Integrated Disease Management (IDM). Experiments on IDM carried out at ICRISAT showed promise in obtaining higher productivity both in pods and fodder with appreciable good quality. This resulted in collaborative studies between ANGRAU, various NGOs and ICRISAT. ANGRAU and its research stations in the Deccan Plateau have been major partners in the evaluation and validation of IDM technology through the on-farm participatory approach in this area.

Collaborating institutes involved in on-farm research are:

- 1995 to 1996 Agricultural Research Station (ARS) of Acharya NG Ranga Agricultural University (ANGRAU), Anantapur; Rural Development Trust (RDT), Anantapur; Krishi Vignan Kendra, Kurnool and Nalgonda
- 1997 to 1998 On-farm trials were devolved by ICRISAT; evaluation of IDM technology was carried out by ARS and RDT, Anantapur. Varieties tested were IGGV 89104 and 91114.
- 1999 to 2000 Agriculture Man Ecology (AME), and its NGO network in Andhra Pradesh and Karnataka.
- 2001 to 2004 District Agricultural Advisory and Transfer of Technology Centre (DAATT Centre) of ANGRAU (Eruvaka); ARS and RDT, Anantapur.

## **The IDM technology package**

ICRISAT and collaborating institutions together initiated the evaluation and validation of IDM technology in Anantapur, Kurnool and Nalgonda districts of Andhra Pradesh in 1995 and 1996. The technology consisted of an improved high-yielding cultivar with moderate host plant resistance, seed treatment with fungicide and one or two sprays with fungicide 'Kavach' (one spray at 65-70 days after sowing (DAS) for the early variety and two sprays: the first at 65-70 DAS and the second, 15 days later for medium maturing cultivars). Groundnut cultivars included ICGVs 89104, 91114, 91123 and 94361 (early maturing) and ICGVs 86590, 86699 and ICGS 76 (medium maturing lines) during 1995 and 1996. In both trials, susceptible TMV 2 and local cultivars were included as checks in all locations. During these two years, ICGVs 89104 and 91114 emerged as potential candidates for on-farm IDM studies as they out-yielded other cultivars in both pod and fodder.

During 1997 and 1998, ARS and RDT evaluated IDM technology through farmers' participatory research in Anantapur district. After the devolutionary period at ICRISAT, on-farm IDM research was conducted from 1999 to 2004. These included two promising early maturing cultivars, ICGVs 89104 and 91114, which were most preferred by farmers, along with a new set of three medium maturing lines, ICGVs 92020, 92093 and 94080 in Andhra Pradesh and Karnataka. Year wise details of locations and trials are given in Table 1.

The year wise highlights of IDM trials are as follows.

### **1995**

All medium-maturing cultivars had lower severities of LLS and rust than TMV 2. Pod yield was higher in all medium-maturing cultivars compared to the local cultivar.

Among the early maturing cultivars ICGVs 89104 and 91114 had moderate level of foliar diseases and yielded better than rest of the cultivars.

### **1996**

With encouraging results and favorable farmers reactions, IDM trials were continued in the 1996 rainy season.

- LLS and rust severities were low in early maturing cultivars in sprayed plots compared to unsprayed plots in all locations (Table 2).
- ICGV 91114 followed by 89104 recorded the highest pod and haulm yields over local cultivars (Table 2).
- These two cultivars were much preferred by most farmers.

**Table 1. Details of participatory on-farm trials conducted.**

Year	District (no. of villages)	Number of trials
1995	Anantapur (2) Kurnool (1) Nalgonda (1)	9
1996	Anantapur (5) Kurnool (3) Nalgonda (4)	12
1997-98	Devolutionary period; however, took up evaluation of IDM technology using ICGVs 89104 and 91114	-
1999	Chittoor (2) Kolar (8)	13
2000	Chittoor (3) Kolar (6)	16
2001	Anantapur (1)	21
2002	Anantapur (2)	45
2003	Anantapur (2)	70
2004	Anantapur (5)	150

**Table 2. Effect of IDM on foliar disease incidence and mean yield in selected short duration groundnut cultivars in on-farm trials, 1996.**

Cultivars	Foliar disease score*		Yield (t/ha)			
			Haulm		Pod	
	IDM	Non-IDM	IDM	Non-IDM	IDM	Non-IDM
ICGV 89104	5.5	8.3	2.58	2.25	1.87	1.40
ICGV 91114	4.7	8.0	2.83	2.40	2.20	1.75
Local variety	6.0	9.0	2.25	1.75	1.06	0.85

\* on a 1-9 rating scale.

### 1997 and 1998

Trends in 1997 and 1998 were similar to those observed in 1995 and 1996 regarding severity of foliar diseases, and pod and fodder yields in the two cultivars ICGV 91114 and 89104. During this period, these two cultivars spread to several farms in the villages.

## 1999

Soon after restoration of on-farm research at ICRISAT, IDM trials were conducted in 10 villages in Andhra Pradesh and Karnataka using ICGV 89104 and 91114. Again, these cultivars proved to be superior to local cultivars in pod and haulm yields in all the trials.

## 2000

During this year, the adoption of IDM technology, with cultivar ICGV 91114 spread not only across farms but also to several villages. The low severity of foliar diseases and high quality fodder from the cultivar ICGV 91114 attracted many farmers.

**Table 3. Mean severity of foliar diseases, and haulm and pod yield as influenced by IDM and non-IDM practices in on-farm trials, 1997-2000.**

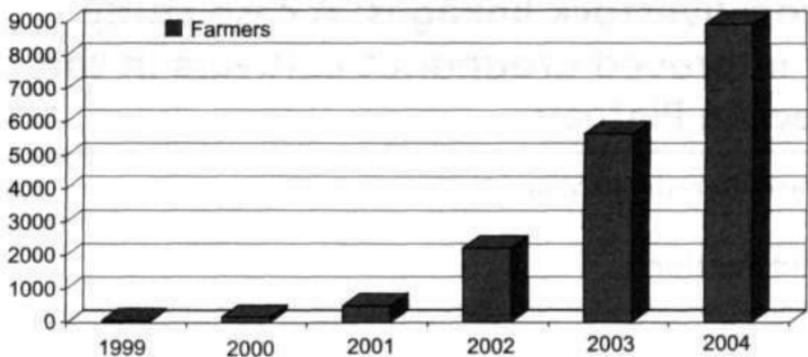
Variety	Disease score on a 1-9 scale		Haulm yield (t/ha)		Pod yield (t/ha)	
	IDM	Non-IDM	IDM	Non-IDM	IDM	Non-IDM
ICGV 89104	7.3	7.7	1.51	1.27	0.99	0.72
ICGV 91114	7.0	7.3	1.70	1.45	1.10	0.78
TMV 2	8.3	9.0	1.12	0.97	0.67	0.55

## 2001 to 2004

The dual purposes of the cultivar ICGV 91114 was appreciated by farmers in several villages and therefore spread rapidly to villages and neighboring districts in Andhra Pradesh and Karnataka (Fig. 1). During this period, ICGV 91114 demonstrated low severities of foliar diseases and high pod and fodder (haulm) yield compared to the local cultivar. Moreover, the fodder was found nutritious and milk yield increased when fed to milch animals.

## Conclusion

Groundnut is entwined with the economic prosperity of the district, where more than two thirds of the population depends on agriculture. The quality and quantity of pod and fodder are affected mainly by foliar diseases and further aggravated collaterally by diseases like stem rot. Diseased fodder has low digestibility and low market value. IDM technology tested in on-farm trials confirmed beyond doubt that management of foliar diseases resulted in concomitant increase in quality of fodder and pod yields. Groundnut variety



*Fig. 2. Progressive adoption and expansion of IDM technology and ICGV 91114 in farmers' fields in the Deccan Plateau.*

ICGV 91114 pleased farmers both in favorable and unfavorable seasons by tiding over drought with superior yields. This is reflected in the fact that farmers rapidly adopted and spread this cultivar.

A tailpiece in the farming system, household dairy is nevertheless an important component that supplements incomes in this ecologically hard-pressed tract of Anantapur. Groundnut haulm has been found to be the main nutritive proteinaceous crop residue for dairy animals. Healthy fodder is more digestible and results in increased milk yields, which supplements farmers' economic status.

Our suggestion is to upscale IDM technology as an innovative program in all area development programs. This must be carried out by agencies such as the District Water Management Agency (DWMA). The multiplication of ICGV 91114 must be promoted as part of work on village level seed system in a participatory mode in watershed areas, as this is the only variety that fits well into the available crop growth period of less than 100 days under rainfed conditions. This cultivar has the potential to replace the traditional local variety TMV 2/JL 24.

# Crop-livestock linkages: A case study of improved groundnut cultivars in the Deccan Plateau

---

P Parthasarathy Rao<sup>1</sup> and V Shravan Kumar<sup>2</sup>

## Introduction

The integrated nature of crop-livestock production is a unique characteristic of agricultural production in most semi-arid tropical countries in Africa and Asia. The inseparability of the two, in fact, sustains the production of each. Livestock provide draught power and manure, while crops provide feed and fodder for animals. The scale of production of both crops and livestock is small, yet the complementarities between the two have considerable social, economic and environmental impact. Livestock are an important source of income and employment for the rural poor and can be considered a living savings bank with offspring as interest. Being liquid compared with land, livestock act as a cushion against risk and uncertainty in crop production.

During the last decade, the demand for milk and meat has grown rapidly due to sustained rise in per capita income and urbanization. Recent estimates show very low to negative elasticity for cereals and pulses, and high elasticity for milk (0.60), meat, fish and eggs (0.89). High expenditure elasticities coupled with high growth in income and population have led to considerable rise in demand for livestock products in recent years. This trend will continue to strengthen in the near future, as the underlying forces will further fuel growth in demand. In India, for example, by 2020 demand for milk and meat is expected to double from 75 million t and 4.4 million t respectively.

India has the largest population of ruminants in South Asia, and livestock production is an integral part of mixed farming systems. To meet the growing demand for livestock products in recent times, specialized peri-urban/urban dairy production has been developed by the landless in many areas. The so-called "livestock revolution" will provide opportunities for increased production of milk to meet the requirements of the increasing human population and lead to improved livelihoods, of those dependent on crop and livestock income.

## Constraints to production

The past performance of the livestock sector however indicates that to a large extent growth in production was number-driven. Livestock productivity both

---

<sup>1</sup> Senior Scientist (Socioeconomics), ICRISAT, Patancheru, Andhra Pradesh, India.

<sup>2</sup> Scientific Officer, ICRISAT, Patancheru, Andhra Pradesh, India.

for milk and meat continues to be abysmally low compared to the world average or domestic potential. One of the most important technical constraints to animal production is the inadequate supply of high quality feed resources throughout the year. As the area of common property resources for grazing continues to decline with increased cultivation, so the dependence on crop residues (mainly fine and coarse cereals and leguminous crops) and agro-industrial by-products (bran, oilcakes etc) are the main sources of feed. In the semi-arid districts of India, crop residues account for almost 55-70% of the total dry matter intake by large ruminants. The residues are stored and used throughout the year, particularly in the dry months when other sources of feed are scarce.

Although crop residues are a major roughage source for ruminants, their nutritive value is often low. Furthermore, crops like sorghum and groundnut are susceptible to a number of foliar and stalk diseases that may reduce production and quality of both crop and residues. In recent years, considerable attention has been paid to alleviate feed scarcity through technological intervention. Chemical and biological treatment of cereal straws is an example. However, much of the work has been on the shelves of research stations. Attempts at transfer of the technology have not succeeded due to technological and socioeconomic constraints at the farm level. Disease resistant improved varieties of crops are an option with potential payoffs.

## **Crop-Livestock interaction on the Deccan Plateau**

Crop-livestock interaction is an important feature of agriculture on the Deccan Plateau. In Anantapur district, traditional dual-purpose sorghum and groundnut crops provide most of the residues. Groundnut is an important crop in Andhra Pradesh, accounting for 18-21 % of total production in India. Anantapur accounts for 46% of groundnut area in Andhra Pradesh where groundnut accounts for 61-77% of the cropped area under irrigated and rainfed conditions.

Groundnut residues are a nutritious source of livestock feed and are used locally either by farmers themselves or exchanged for food and other crop residues. Sales of cereal crop residues to peri-urban/urban milk producers' account for a large share of the income derived from cropping in rural areas. Depending on stover quality, farmers are getting more income from the sale of crop residues.

## **Household surveys**

Farmer surveys conducted during 2003-04 in two project villages, Gummallakunta and Jalalapuram of Bathalapalli mandal, indicate that groundnut accounts for 61-75% of the cropped area under rainfed conditions. The balance is made up

by sorghum (1-10%), paddy rice (1-6%), permanent crops (13-22%) and other crops. Only a small proportion of groundnut is irrigated in the post-rainy season. About 10% of the area cultivated by farmers in the sample was planted with the improved groundnut cultivars promoted by the project. The household surveys were carried out primarily to assess the performance of improved cultivars against traditional ones.

On average, farmers were found to own 2-3 milk animals, and buffalo outnumbered cows. About 50% of the households maintained a pair of bullocks for traction. The main sources of feed were groundnut residue, paddy rice and sorghum, green grass from bunds (especially in the wet season), and forage from grazing common property resources and fallows. Groundnut haulms were found to provide >50% of dry fodder, and >25% of the haulm fed to animals was traded (exchanged) within the village. Farmers purchased 75% of paddy rice straw and about 50% of sorghum stover from outside the village. In many cases, paddy straw was purchased from distances 100-150 km away. Rice bran and concentrate mixtures were bought in the nearest town, and reserved for lactating animals and bullocks used for land preparation in the planting season.

Pest and disease incidence in groundnut is an important constraint that reduces yields of both pod and haulm. Farmers generally felt that yield loss was higher due to foliar diseases (Table 1).

**Table 1. Percentage of yield loss due to diseases.**

Yield loss (%)	Number of farmers			
	Gummallakunta*		Jalalapuram**	
	Grain	Haulm	Grain	Haulm
10	7	1	3	2
15	7	2	3	1
20	5	9	2	4
25	1	5	-	-
30	-	2	-	5
35	-	1	-	-

\* Sample farmers = 20

\*\* Sample farmers = 12

Source: Survey data 2003-2004.

The effect of diseased stover on selected indicators is shown in Table 2. Generally, farmers perceived a decline in milk yield due to feeding of diseased haulm.

**Table 2. Effect of diseased haulm on select indicators.**

Effects	Number of farmers			
	Gummallakunta*		Jalalapuram**	
	No change	Decreased by 25%	No change	Decreased by 25%
Market price of stover	17	3	12 -	
Animal growth	13	7	7	5
Milk yield	3	16	1	11
Milk quality	19	1	12 -	
Milk price	19 -		12 -	

\* Sample farmers = 20

\*\* Sample farmers = 12

Source: Survey data 2003-2004.

### Farmer perceptions and profitability of improved cultivars

The 2004-2005 season received good rainfall, and data was available from farmers for economic analysis. Nine farmers grew the local variety JL 24 and 37 farmers cropped the most popular variety TMV 2 and they were asked for their perceptions of the new improved cultivar ICGV 91114. The results are presented in Table 3.

The majority of farmers growing both local varieties think that ICGV 91114 is superior by 25-50% in terms of grain/fodder yield, grain/fodder quality, palatability, resistance to diseases and drought tolerance. A majority of farmers think that there are no differences between cultivars with respect to inputs of labor/materials required.

The involved costs and returns from improved cultivar ICGV 91114 or local varieties JL 24 and TMV 2 in three villages under rainfed or irrigated conditions are shown in Table 4. Pod and haulm yields were highest for ICGV 91114. Gross returns were much higher for the new improved cultivar. Although the costs of cultivation were marginally higher for ICGV 91114, the overall costs of production were 9% lower for the new cultivar under irrigation and 8% lower in rainfed conditions. Net returns from growing ICGV 91114 were about 29% higher under irrigation and 25% higher under rainfed conditions.

Table 3. Farmers assessment ICGV 91114 in comparison with traditional varieties.

	ICGV 91114 versus JL 24*			ICGV 91114 versus TMV 2**				
	No difference	Slightly higher/better (25%)	Much higher/better (>50%)	Lower than farmers' varieties	No difference	Slightly higher/better (25%)	Much higher/better (>50%)	Lower than farmers' varieties
Grain yield	-	6	1	2	1	19	14	2
Fodder yield	2	6	1	-	1	32	1	2
Grain quality	-	8	-	-	-	35	1	-
Fodder quality	-	8	-	-	-	33	-	-
Fodder palatability	-	7	-	-	1	20	1	-
Disease resistant	1	-	7	1	2	11	13	10
Pest resistant	6	3	-	-	21	15	-	-
Drought resistant	-	4	4	1	4	15	13	3
Labor inputs	9	-	-	-	36	-	-	-
Material inputs	8	1	-	-	36	-	-	-

Source: Survey data.

\*Number of farmers = 9

\*\*Number of farmers = 37.

**Table 4. Costs and returns for improved and local groundnut varieties, Anantapur, 2004-2005.**

Parameter	Irrigated			Rainfed	
	TMV 2	JL 24	ICGV 91114	TMV 2	ICGV 91114
Pod yield (kg/ha)	1322	1216	1567	1040	1231
Haulm yield (kg/ha)	1730	1730	2224	1483	1730
Gross returns (Rs/ha)	24291	24637	29450	19215	22541
Cost of cultivation (Rs/ha)	9558	10008	10472	8814	9561
Net returns (Rs/ha)	14733	14629	18978	10403	12981
Cost of production (Rs/kg)	7.2	8.2	6.7	8.5	7.8

Data collected from sample farmers from three project villages.  
Source: Survey data.

### Impact on milk yield

Laboratory analyses of groundnut haulms from farms confirm that the feeding value of improved cultivars is high. The range of values for crude protein content, *in vitro* digestibility and metabolizable energy were 13.9-15.8%, 63.2-65.3% and 8.8-9.2 MJ/kg, respectively. Laboratory measurements were similar across cultivars and farms.

Milk yields in animals (mostly buffaloes but also dairy cows) fed haulms from improved cultivar 91114 was about 10% higher (4.36 kg/day) than when animals were fed the local cultivars TMV 2 and JL 24 (3.92 kg/day).

### Conclusion

The advantages of growing improved cultivars are threefold:

- 1) higher pod yields,
- 2) higher haulm yields and
- 3) higher milk yields from dairy animals that are fed the haulms.

Currently, farmers are receiving about Rs 24-28/kg for seed of improved cultivar ICGV 91114 compared to Rs 18-22/kg for seed of traditional varieties. Milk yields per animal on farm are 0.44 kg/day higher with haulm ICGV 91114 than with the local varieties. Some 70-80% of milk is sold through both formal and informal sources.

At current rates of adoption, it is anticipated that some 80,000 hectares of groundnut (10% of the total crop) in Anantapur district will be under improved cultivars by 2010, and that there will be dissemination of seed into the adjoining states of Karnataka and Tamil Nadu. Demand for high quality crop residues will

increase in the future. The new disease-resistant, dual-purpose cultivars will thus contribute to increased groundnut and milk production and consequently raise incomes at the farm level leading to improved livelihoods for small-scale farmers.

# **Session I: Integrated crop and pest management in groundnut**

---



# Improved crop husbandry practices in groundnut in dryland agriculture: Need and scope

T Yellamanda Reddy<sup>1</sup>

Among oilseed crops, groundnut holds first place in India. In Andhra Pradesh, it is grown in an area of 2.2 million ha with a production of 1.5 million tonnes and productivity of 842 kg/ha. Groundnut seed contains about 45 percent oil and 26 percent protein. It is a good source of B vitamin except for B<sub>12</sub> and thiamine, riboflavin, nicotinic acid and vitamin E.

In the Deccan Plateau, the ideal time for sowing rainfed groundnut is from the second week of July to the first week of August. Delay in sowing beyond the first week of August leads to lower yields (Table 1) as the crop faces drought at the pod filling stage.

**Table 1. The effects of sowing dates on yield and yield attributes of groundnut during the kharif season, 2001, ARS, Anantapur.**

Date of sowing	No. of pods/m	Pod yield (kg/ha)	Haulm yield (kg/ha)	Shelling %	100-seed weight (g)
8 July	350	1582	2130	69.9	25.94
1 August	147	1236	1815	70.12	25.15
30 August	105	547	333	65.33	21.73

## Tillage

Light textured soils with low organic matter and routine soil manipulation in the form of tillage operations are more prone to either wind or water erosion. Soils of Anantapur are shallow in depth, low in organic matter content and almost without structure. Minimum tillage in general may help improve the soil structure, organic matter content, interception of rainwater and may reduce soil erosion. Experiments conducted at ARS, Anantapur, revealed that there was no significant difference in yields between conventional tillage and minimum tillage (Table 2). Minimum tillage therefore is recommended in order to raise a successful crop.

<sup>1</sup>Principal Scientist (Dryland Agriculture), ARS, Anantapur, Andhra Pradesh, India.

**Table 2. Mean effect of tillage practices on groundnut yields, ARS, Anantapur\*.**

Treatments	Pod yield (kg/ha)	Haulm yield (kg/ha)	Shelling %
Conventional tillage	1020	1748	67.3
Low tillage	951	1725	66.2
LSD (5%)	Non-significant	Non-significant	Non-significant

\* Mean of five years (2000 to 2004).

In groundnut, seed cost constitutes 30% of the total cost of cultivation. Farmers generally grade the seed, and bold seed is used for sowing and shriveled seed is discarded. On-farm trials conducted during 2003 and 2004 rainy seasons in 50 farmers' fields revealed that crop sown with partially shriveled seed gave yields on par with crops sown with bold seed (Table 3).

**Table 3. Effect of partially shriveled groundnut seed on pod yields in on-farm trials.**

Treatment	Pod yield (kg/ha)*
Normal seed	405
Partially shriveled seed	472

\* Average from 50 trials.

## Seed treatment

Seed treatment with fungicide is very important as it protects the crop from seed and soil-borne diseases. Seed treatment with Mancozeb @ 3 g/kg seed or carbendazim @ 2 g/kg seed helps reduce soil borne diseases like collar rot, stem rot etc. Peanut stem necrosis disease (PSND) can be controlled by treating the seed with Imidacloprid @ 1 ml/kg seed and chloropyriphos @ 6 ml/kg seed to avoid root grub incidence.

## Sowing

CRIDA-ANGRAU have developed a 9-row planter that can be used for groundnut sowing along with intercrop sowing at a ratio of 8:1. This planter maintains the recommended seed rate of 90-100 kg kernels/ha and covers an

area of 6 to 7 ha/day of 8 hours. The cost of sowing with this machine works out to Rs 350/ha compared to Rs 500/ha with an animal drawn seed *drill* (Table 4).

**Table 4. Performance of the CRIDA-ANGRAU planter vis-a-vis the local seed drill.**

Planter	Seed rate (kg/ha)	Population (m <sup>2</sup> )	Average intra row spacing (cm)	Field capacity (ha/hr)
CRIDA-ANGRAU planter	90	33	10.23	0.50
Local seed drill	124	42	8.86	0.46

## Nutrient management

**Permanent manure trial:** The results of 19 years' research in this district revealed that inorganic fertilizer input can be reduced by 50% by adding either groundnut shells or FYM @ 4 t/ha (Table 5). Further, there was improvement in the physical structure of soil, infiltration rate and moisture holding capacity and decrease in runoff losses due to the use of organics. There was a significant build up of available phosphorus due to continuous use of inorganic fertilizers (Table 6). Soil biological activity in terms of dehydrogenase enzyme activity increased with the application of FYM.

**Fertilizer application based on soil analysis:** Experiments conducted at Anantapur indicated that fertilizer application based on soil analysis was the best method to obtain higher pod yields with reduced cost of cultivation by avoiding application of excess fertilizers (Table 7). In this method, soil is analyzed for availability of NPK elements.

The steps suggested for groundnut are:

- If soil analyses reveal low levels of nitrogen, phosphorus and potash, the full-recommended dose of chemical fertilizer viz, 8-16-16 kg of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O/acre must be applied.
- If results reveal medium levels of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O, then half the recommended dose must be applied.
- If the status is high, no fertilizer need be applied, and the investment on the fertilizer component can be rationalized.

**Soil Amendments:** An experiment was conducted in Anantapur from 1997 to 2000 to study the effect of application of sand, gypsum and farmyard manure as amendments to create a favorable environment in the soil for groundnut crop growth and yield (Table 8) on hard surface crusting soils (alfisols).

**Table 5. Effects of long term Integrated Nutrient Management on pod yield of groundnut over years.**

Year	Pod yield (kg/ha)									
	T1	T2	T3	T4	T5	T6	T7	T8	T9	CD
1985	1186	1367	1288	1187	1058	1077	1197	1309	991	84
1986	902	1055	943	1300	1168	1233	960	1072	945	204
1987	1364	1467	1428	1518	1240	1478	1447	1473	1161	NS
1988	1480	1786	1920	1605	1915	1741	1912	2040	1977	280
1989	1156	1446	1385	1129	1516	1152	1541	1453	1508	215
1990	1099	1264	1316	1348	1290	1218	1315	1238	1302	NS
1991	381	608	547	507	569	524	491	432	424	NS
1992	1016	1250	1143	1207	1130	1250	1352	1280	1141	NS
1993	493	745	724	634	662	642	716	733	626	NS
1994	469	658	568	633	625	757	708	642	601	130
1995	760	1111	984	799	926	1004	994	1131	946	84
1996	563	632	625	688	660	701	701	694	653	NS
1997	241	410	347	333	320	338	336	297	329	66
1998	966	1250	1112	1013	1088	1256	1182	1329	1087	NS
1999	823	1265	1080	957	1018	1152	1337	1348	988	123
2000	613	658	740	575	740	636	792	694	679	NS
2001	1034	1085	1188	888	1148	942	1302	930	1151	201
2002	451	363	391	498	410	522	456	415	460	NS
2003	441	385	366	577	414	588	328	401	267	89
2004	955	1546	1342	1196	1433	1419	1295	1370	1380	204
Mean	819.7	1017.6	971.9	929.6	966.5	981.5	1018.1	1014.1	930.8	-

Treatments: T1: Control; T2: Recommended fertilizer dose (RFD); T3: Half RFD; T4: Groundnut shells (GNS) 4 t/ha; T5: Farmyard manure (FYM) 4 t/ha; T6: T3 + T4; T7: T3 + T5; T8: RFD + zinc sulphate; T9: FYM 5 t/ha; T10: T2 + T4

CD = Critical difference; NS = Not sown.

**Bio-fertilizers:** Experiments conducted for three years at Anantapur revealed that addition of bio-fertilizers did not influence the yield of groundnut (Table 9). It was concluded that application of bio-fertilizers under rainfed conditions may not be useful for groundnut production in this district.

## Intercultivation

Normally, intercultivation or ploughing between crop rows to kill weeds is needed to keep the crop weed free. This is done twice, at 25 and 35 days after sowing (DAS). Most farmers use an animal drawn four-typed blade harrow, locally known as '*metla guntaka*', which is a labor intensive and time consuming

**Table 6. Effects of long term Integrated Nutrient Management on the physio-chemical properties and available nutrients of soil.**

Treatment	pH	EC (dS/m)	OC (%)	Available nutrients (kg/ha)	
				P	K
T1 Control	6.2	0.024	0.32	9.7	100
T2 Recommended fertilizer dose (RFD)	5.7	0.069	0.20	55.3	249
T3 Half RFD	5.8	0.038	0.21	42.5	163
T4 Groundnut shells (GNS) @ 4 t/ha	5.9	0.031	0.29	18.9	215
T5 Farmyard manure (FYM) @ 4 t/ha	7.3	0.082	0.60	38.8	317
T6 T3 + T4	5.6	0.042	0.34	44.0	318
T7 T3 + T5	7.0	0.084	0.43	54.5	350
T8 T2 + ZnSO <sub>4</sub> 50 kg/ha (once in 3 years)	5.5	0.051	0.26	59.7	228
T9 FYM @ 5 t/ha	7.4	0.096	0.52	43.2	404
CD (0.05)	0.3	0.03	0.06	12.5	57.2
CV%	2.8	17.6	10.0	18.5	13.0
Initial values (1985)	6.6	0.15	0.25	19.2	155

EC (dS/m) = Electrical Conductivity (Desi Siemens/meter)

OC = Organic Carbon

P = Phosphorus

K = Potash

**Table 7. Effects of soil test based fertilizer application on groundnut yield at Rekulakunta village during kharif, 2004\*.**

Treatment	Pod yield (kg/ha)	Haulm yield (kg/ha)	No. of matured pods/plant	Shelling (%)	Test weight (g)
Fertilizer based on soil test value	1699	2963	10.9	76.4	34.7
Local practice (1 bag of Di-ammonium phosphate of 50 kg )	1723	3010	11.3	76.8	36.0

\* All statistics are mean of 14 trials.

**Table 8. Effects of soil amendments on the soil's physical properties and yield of groundnut\*.**

Treatment	Soil crust strength (kg/cm <sup>2</sup> )	Infiltration rate (mm/minute)	Water holding capacity (%)	Pod yield (kg/ha)
T1: Control	1.36	12.5	29.9	761
T2: Sand @ 40 t/ha once in two years	1.27	14.0	30.5	870
T3: Gypsum @ 2 t/ha + FYM @ 5 t/ha every year	1.16	15.0	31.4	969

\*All statistics are mean of 3 years.

**Table 9. Effects of bio-fertilizers on groundnut yield.**

Treatments	Pod yield (kg/ha)			Haulm yield (kg/ha)		
	1997	1998	1999	1997	1998	1999
T1: Control	370	1979	1022	1576	2125	1389
T2: NPK	537	2309	933	2104	2125	1852
T3: Rhizobium @ 500 g/ha + PSB @ 500 g/ha	539	1822	1080	2027	2167	1736
T4: Rhizobium + Phosphate solubilizing bacteria (PSB) + NPK	537	2563	1203	1993	2750	1697
CD (5%)	104	343.7	NS	NS	NS	480

device. Instead, the tractor drawn mechanical sweep developed by ANGRAU can be used to complete the task faster where labor and bullock power are constraints (4 to 5 ha in a day).

Alternately, weeds can also be controlled by herbicides effectively. Pendimethalin (Stomp) 2 to 2.5 l/ha as pre-emergence application or butachlor (Matchet) 2.5 to 3 l/ha as a pre-emergence application also effectively controls most broad leaved weeds.

## Water management

**Polythene film mulching:** Field experiments were conducted in the late kharif seasons of 1998 and 1999, with polythene film as mulch on raised and flat beds. It was found that there was an increase of 22.8% in raised beds with mulch and 75.9% in flat beds with mulch over control. This was mostly due to conservation of soil moisture with mulch in the root zone area (Table 10).

**Table 10. Effects of polythene film mulch on groundnut yield.**

Treatments	Pod yield kg/ha			Haulm yield (units) kg/ha		
	1998	1999	Mean	1998	1999	Mean
Raised bed with mulch	2496	1980	2238	2542	1619	2081
Raised bed without mulch	2421	1225	1823	2457	1497	1977
Flat bed with mulch	4050	2580	3315	4700	2059	3380
Flat bed without mulch	2067	1703	1885	4020	2383	3177
SE m ±	220			266		
CD 5%	678			NS		

**Water harvesting and irrigation in rainfed crop:** Water harvesting and supplementary irrigation was found feasible and increased pod yield by 20-40% (Table 11). The optimum size of a farm pond is 10 m x 10 m x 2.5 m and can store about 2 lakh liters of runoff water. Supplementary irrigation with stored runoff water through sprinkler systems with a quantity of 10 mm for duration of one hour is sufficient to restore crop vigor particularly during pod maturity stages. This is usually necessary if the dry spell lasts longer than 10 days.

To avoid seepage and losses from storage ponds, different lining materials like Kadapa slabs, sodic soil, cement + bricks, cement + cement bricks and cement + soil (1:8) were tested at ARS, Anantapur. Of these, lining with cement + soil (1:8) proved to be more effective and economical (Table 12).

**Irrigated rabi crop:** Groundnut needs 400-450 mm of water every season. In light textured soils, 8-9 irrigations are necessary. The pod filling stage is the most critical stage for moisture. Weekly irrigation from 60-80 days helps obtain higher pod yields.

**Table 11. Effects of supplementary irrigation on yield attributes and groundnut yield during kharif, 2004.**

Parameters	Rainfed	With supplementary irrigation
Filled pods/m <sup>2</sup>	50	153
100-pod weight (g)	43	45
Shelling (%)	68	69
Pod yield (kg/ha)	315	698
Haulm yield (kg/ha)	1250	1843

**Table 12. Cost of farm ponds with different lining materials.**

Lining material	Cost (Rs)
Kadapa slabs	25000
Sodic soil	8000
Cement + bricks	25000
Cement + cement bricks	25000
Cement + soil (1:8)	10000

## Recommended pest management practices

### Red hairy caterpillar

- Deep ploughing to expose and kill pupae during the hot summer months (March to June).
- Adults can be trapped by using light traps or setting up of bonfires in the fields two days after rain from 8.00 to 10.00 pm. As a supportive measure, a pan filled with either soap water/kerosene may be set up below the light source to kill the adults.
- Dusting of folidol around the light traps on the ground and on field bunds to destroy the early instar larvae.
- Vegetative trapping of larvae by sowing trap crops like cowpea, greengram and castor, and dusting with folidol after observing initial scrapings on leaves of trap crops.
- Poison baiting to control grown up larvae by using 10 kg of rice bran mixed with one kg of jaggery and one litre of quinalphos.

## Leaf webber

- Application of quinalphos @ 2 ml/l at the first and second instar.
- After web formation, application of monocrotophos @ 1.6 ml/l or chlorpyrifos @ 2 ml/l of water is recommended after larvae have been exposed by drawing a thorny bush across the crop.

## Late leaf spot

- Late leaf spot can be reasonably predicted three days in advance based on leaf moisture. Fungicidal spraying can be taken up after this.
- One spray at 70 DAS with 1 g of carbendazim + 2 g of mancozeb/l of water effectively controls late leaf spot for Anantapur and Kurnool districts where medium duration types are grown.
- Other chemicals like chlorothalonil @ 2 g/l or hexaconazole @ 2 ml/l at 70 DAS are effective.

## Peanut Stem Necrosis Disease (PSND)

- Removal of weed hosts like Parthenium before flowering.
- Seed treatment with Imidacloprid @ 1.0 ml/kg of seed.
- Border cropping with maize, sorghum or pearl millet reduce incidence of the disease.

## Harvesting

With draught power dwindling, the tractor-drawn ANGRAU blade '*guntaka*' (SWEEP) can be used to harvest groundnut. The *guntaka* can cover four rows at a time and harvests 4-5 ha a day. The cost of the unit is Rs 6000/- and the cost of operation is Rs 500/ha. Harvesting operation done at the right time helps avoid loss of pods in the field.

## Threshing and decorticating

A groundnut thresher can be used for stripping groundnut pods mechanically. The thresher has high stripping capacity of 200 to 300 kg per day. The cost of operation is about Rs 33/q of pods. It was found advantageous to thresh the crop immediately after harvest ie, within five days after harvest as the threshing and cleaning efficiency is high (Table 13). The thresher can be used also as decorticator by changing the cylinder and sieve. It can decorticate upto 3 to 4 tons of groundnut pods a day.

**Table 13. Performance of the peg type groundnut thresher.**

Treatment	Moisture content (%) w.b		Threshing efficiency	Cleaning efficiency (%)	Broken (%)	Capacity (ha/hr)
	Pods	Haulms				
T1	38.36	42.07	96.65	98.08	10.07	0.25
T2	30.57	40.41	95.92	99.00	16.18	0.23
T3	19.16	38.44	96.44	98.43	15.77	0.25
T4	15.45	32.99	89.89	97.50	12.16	0.33
T5	11.86	28.18	92.34	93.33	12.08	0.20
T6	10.62	20.35	96.90	92.00	10.70	0.20
T7	10.12	10.40	96.11	96.67	18.78	0.23

T1: 1st day after harvest; T2: 3rd day after harvest; T3: 5th day after harvest; T4: 10th day after harvest; T5: 15th day after harvest; T6: 13th day after harvest; T7: 14th day after harvest.

**Storage:** Groundnut pods with 8% moisture can be stored in gunny bags @ 40 kg/bag. Cleaning and removal of ill filled and immature pods aids safe storage. The bags must be laid on the wooden dunnages for free aeration. Bags should be laid in a crisscross manner, a little distance from side walls and the heap height must allow a clearance of three feet to the roof. Periodical cleaning of the walls and bag surfaces at weekly intervals reduces the damage from storage pests. Aflatoxin contamination can be avoided by removal of damaged and ill filled pods. If storage pests like bruchids are noticed, it is recommended to spray the bags with Malathion @ 2 ml/l of water or place celphos tablets with the bags.

# Integrated management of groundnut fungal diseases

S Pande<sup>1</sup>, G Krishna Kishore<sup>2</sup> and J Narayana Rao<sup>3</sup>

## Introduction

Groundnut (*Arachis hypogaea* L.) is grown in 8.2 million ha in India, with a production of 6.2 million tons annually. It contributes 29% of the total oilseed production. Average pod yield of groundnut in India is less than 1000 kg/ha compared to 2650 kg/ha or more in developed countries. Groundnut diseases are caused by more than 100 fungal, viral and nematode pathogens, and these are the biotic constraints that limit pod and haulm yield in this crop (Pande et al. 1996). Economically important fungal diseases of groundnut in the Deccan Plateau are early leaf spot (ELS), late leaf spot (LLS), rust, collar rot, stem rot, aflatoxin contamination and bud necrosis (Table 1). These diseases are reported from all groundnut-growing areas of the country, and distribution of these diseases along with bud necrosis/stem necrosis is presented in Figures 1 and 2.

**Table 1. Economically important diseases of groundnut in India and their estimated yield losses.**

Disease	Causal organism	Yield losses
<i>Fungal diseases</i>		
Early leaf spot	<i>Cercospora arachidicola</i>	10-50%
Late leaf spot	<i>Phaeoisariopsis personata</i>	10-50%
Rust	<i>Puccinia arachidis</i>	10-50%
Collar rot	<i>Aspergillus niger</i>	5-10%
Stem and pod rot	<i>Sclerotium rolfsii</i>	10-20%
Aflatoxin contamination	<i>Aspergillus flavus</i>	*
<i>Viral diseases</i>		
Peanut bud necrosis	Tomato spotted wilt virus	10-20%
<i>Nematode disease</i>		
Root-knot	<i>Meloidogyne arenaria</i> , <i>M. incognita</i>	5-10%

\* Aflatoxin contamination mainly causes qualitative losses of yield and quantitative losses in market and trade, in addition to human health hazards. Yield losses due to preharvest aflatoxin contamination are reported to 10-30% and can be greater depending on the climate.

<sup>1</sup> Principal Scientist (Pathology), ICRISAT, Patancheru, Andhra Pradesh, India.

<sup>2</sup> Visiting Scientist (Pathology), ICRISAT, Patancheru, Andhra Pradesh, India.

<sup>3</sup> Senior Scientific Officer (Pathology), ICRISAT, Patancheru, Andhra Pradesh, India.



# Disease management practices and IDM

## Definition and concept

Integrated Disease management (IDM) as a part of Integrated Pest Management (IPM) is defined by the Office of Technology Assessment, USA, as "the optimization of disease control measures in an economically and ecologically sound manner, accomplished by the coordinated use of multiple tactics to assure stable crop production and to maintain pathogen damage below the economic injury level whilst minimizing hazards to humans, animals, plants and the environment" (Jeger 2000). The major characteristics of IDM technology are: (a) cost-effectiveness, (b) reduced fungicide usage, (c) environment friendliness and (d) long term sociological benefits in terms of employment and public health.

Disease management practices of groundnut mostly vary from no-input to moderate use of fungicides. The exploitation of host plant resistance (HPR) is not significant. IDM technology includes a judicious use of fungicides, host plant resistance, biocontrol agents and recommended cultural practices. Reducing costs associated with disease management in groundnut production systems in India will become increasingly important due to changes in federal legislation that reduced support prices and removed the escalator provision. The number of groundnut growing farmers adopting IDM technology is not very large, and there is an urgent need to educate more farmers about the adoption, benefits and economic returns of IDM technology. In this paper, we emphasize the available options for management of economically important fungal diseases of groundnut in order to design an effective IDM package. Further, on-farm attempts for effective and economical disease control using a rational combination of different available management strategies are presented.

## Integrated management of groundnut foliar fungal diseases

The occurrence and severity of foliar diseases, ELS, LLS and rust, largely depends on the genotype, available inoculum, geographical region and mainly on epidemiological factors during the crop season. When weather conditions are conducive, foliar diseases cannot be managed by any one of the available options; hence, location specific IDM is essential to protect the crop and obtain economic yield. Also, the non-availability of desired levels of host plant resistance in cultivated genotypes necessitates an integrated approach for foliar diseases control. Various components identified for foliar diseases management are:

**Host plant resistance (HPR).** Groundnut cultivars currently in use by farmers are susceptible to foliar diseases and varieties that combine desirable levels

of disease resistance and agronomic traits are scarce. A world collection of groundnut germplasm from 92 countries (> 14,000 accessions) and advanced breeding material (> 400 accessions) wild species were screened for foliar disease resistance at ICRISAT. The large-scale screening resulted in identification of wild accessions with high and moderate levels of resistance (Subrahmanyam et al. 1995). Attempts have been made to transfer disease resistance traits into the most popular genotypes through breeding programs and more than 20 genotypes have been released in India. High levels of resistance to LLS and rust were identified in *wild Arachis* spp. (Pande and Rao 2001) and continued efforts are being made to transfer genes from wild *Arachis* to cultigens. Among the breeding lines, ICG V 91114, a short duration dual-purpose, IDM-responsive genotype was found suitable and acceptable to most farmers in the Deccan Plateau (Pande et al. 2001).

**Chemical control.** Fungicides such as carbendazim, chlorothalonil, tridemorph and mancozeb, either alone or in combination had a high potential to control foliar diseases of groundnut (Reddy 1982; Sawant 2000; Culbreath et al. 2002). These fungicides should be applied @ 500 l of spray fluid/ha at a regular interval of 15 days starting from 45 days after sowing (DAS) until harvest. Nutritional management was also observed to have an effect on the chemical control of leaf spot diseases. Application of mancozeb along with nitrogen-phosphorus-potassium (NPK) and farmyard manure was found more effective than mancozeb alone and NPK + mancozeb (Bag et al. 2000).

**Cultural control.** Cultural practices include crop rotation for 2-3 years, phyto sanitation, adjustment of sowing date to avoid weather conditions favorable for disease development (Hazarika et al. 2000), row spacing, plant population densities (Pande and Narayana Rao 2002) and intercropping that retards the development of foliar diseases. However, these practices have long been neglected in groundnut cultivation in the Deccan Plateau.

Fungicide trials at ICRISAT indicated that carbendazim @ 1g/l of water or chlorothalonil @ 2 g/l water at 60-70 DAS (one spray) for early maturing cultivars and one spray at 60-70 DAS and a repeat 15 days later effectively controls foliar diseases in groundnut.

**Biological control.** Several mycoparasites affect groundnut. These include *Acremonium obclavatum*, *Dicyma pulvinata*, *Fusarium* spp., *Penicillium* spp. and *Verticillium lecanii*, parasitizes *C. arachidicola*, *P. personata* and *P. arachidis* (Podile and Kishore 2002). However, field application of these mycoparasites is limited by their poor survival in the phylloplane.

A chlorothalonil-tolerant *Pseudomonas aeruginosa* GSE 18, when applied in combination with chlorothalonil reduced the effective dose of fungicide required for LLS control by three times (Kishore et al. 2005a) (Fig. 3).

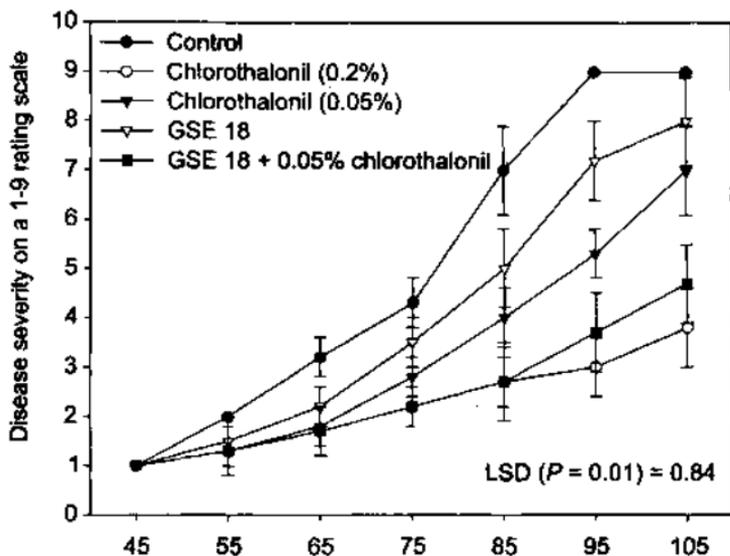


Fig. 3. Field evaluation of chlorothalonil-tolerant *Pseudomonas aeruginosa* GSE 18 for control of late leaf spot in groundnut.

**Plant extracts.** Aqueous leaf extracts and oil from *Azadirachta indica* significantly reduced the severity of LLS and rust in field, and these are often comparable to chemical fungicides. Leaf extracts of *Lawsonia inermis*, *Nerium odorum* and *Calotropis* sp. reduced the severity of foliar diseases (reviewed by Podile and Kishore 2002). Limnoids isolated from *A. indica* (Suresh et al. 1997) and a tetranotriterpenoid compound, cedrelone from *Toona ciliata* had potent antifungal activity against *P. arachidis* (Govindachari et al. 2000) and reduced rust pustule emergence effectively.

Aqueous leaf extract of *Datura metel* (DME) and *Lawsonia inermis* completely inhibited the spore germination of *P. personata* and *P. arachidis*. DME was tolerant to high temperatures and retained its antifungal activity up to 180 days at room temperature. DME and *L. inermis* extract significantly reduced the incidence of LLS upto harvest and increased pod yields upto 48.0% (Kishore et al. 2002). The extracts applied in combination with chlorothalonil further improved the disease control and reduced fungicide requirement (Fig. 4).

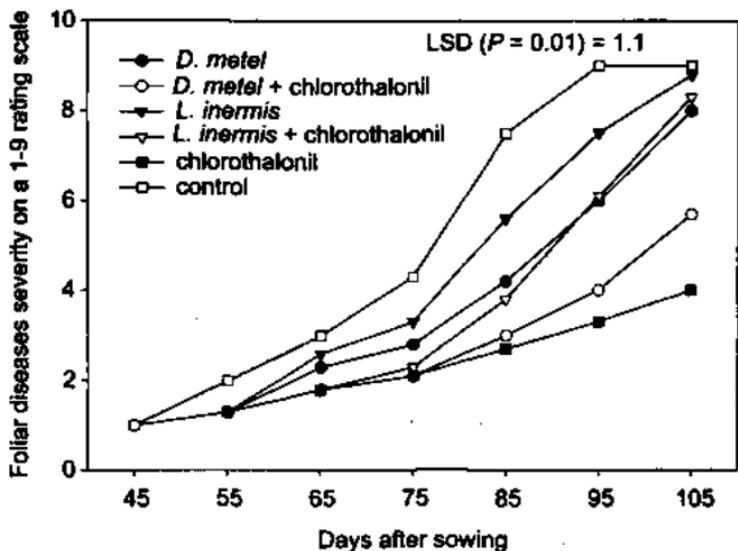


Fig. 4. Effect of integrated applications of aqueous leaf extracts of *Datura metel* or *Lawsonia inermis* and chlorothalonil on the combined severity of late leaf spot and rust diseases of groundnut in field.

## Integrated management of soil-borne fungal diseases in groundnut

**Host Plant Resistance.** Host plant resistance against soil-borne fungal diseases, stem rot, collar rot and aflatoxin contaminations has not yet been identified in cultivated genotypes of groundnut. Although several genotypes are reported to possess resistance to seed colonization by *A. flavus*, seed invasion and/or aflatoxin production, a high level of stable resistance to aflatoxin contamination has not been identified in cultivated groundnut.

**Chemical control.** Chemical control of stem rot is expensive and makes the crop uneconomical. Seed treatment with Thiram or Captan @ 2 g/kg is effective in control of both collar rot and reducing *A. flavus* invasion and subsequent aflatoxin contamination to a certain extent.

**Cultural control.** Terminal drought during 30-40 days before harvest drastically enhances seed invasion and production of aflatoxins by *A. flavus*. Avoidance of terminal drought is recommended to reduce its incidence. Also, storage of groundnuts after proper drying with shell moisture content of 10-11% reduces postharvest aflatoxin contamination. Other cultural practices including crop rotation for 2-3 years with non-host crops, use of apparently healthy seed

for planting, proper weed control, removal of crop debris from the field after harvest reduces the inoculum build up and subsequent infection by *A. flavus*, *A. niger* and *S. rolfisii*.

Biological control. *Trichoderma* spp. has been identified as a potent biocontrol agent of collar rot and stem rot in controlled environments and to a limited extent in the field (Podile and Kishore 2002). Fungicide tolerant *P. aeruginosa* GSE 18 was identified for its suitable application along with Thiram for improved control of collar rot (Kishore et al. 2005b).

## Conclusion

Integrated management of foliar diseases is essential for cost-effective production of groundnut. More economical components of IDM such as biological control and use of plant extracts need to be encouraged in addition to host plant resistance and chemical control. Further details on the epidemiology, plant age, fertilizer application and cultural practices on foliar diseases severity will be helpful in designing disease prediction models. Also, pathogen variation in aggressiveness and virulence exists and should be considered in developing disease management strategies and simulation models. A combination of disease further enhances the scope of IDM technology. Estimation and popularization of the economic impacts of IDM technology is also of equal importance for large-scale adoption of IDM technology by resource-poor farmers. Free international exchange of genetic resources facilitates the access of genetic material to researchers across the world and to use the resistance sources to develop disease resistant breeding lines. Application of transgenic plant technology has enormous potential to increase disease resistance and also to improve other quality traits of groundnut. For the present time, IDM of groundnut diseases using a combination of available host plant resistance and rational use of fungicides is desirable.

## References

- Bag SS, Raj SK and Das S. 2000.** Management of leaf spots of groundnut by nutrition and fungicide: An integrated approach. International Arachis Newsletter. 20:51-53.
- Culbreath AK, Stevenson KL and Brenneman TB. 2002.** Management of late leaf spot of peanut with benomyl and chlorothalonil: A study in preserving fungicide utility. Plant Dis. 86:349-355.
- Govindachari TR, Suresh G, Gopalakrishnan G, Masilamani S and Banumathi B. 2000.** Antifungal activity of some tetranortriterpenoids. Fitoterapia. 71:317-320.
- Hazarika DK, Dubey LN and Das KK. 2000.** Effect of sowing dates and weather factors on development of leaf spots and rust of groundnut. J. Mycol. Pl. Pathol. 30:27-30.

**Jeger MJ. 2000.** Bottlenecks in IPM. Crop Prot. 19:787-792.

**Kishore GK, Pande S and Podile AR. 2005a.** Biological control of late leaf spot of groundnut (*Arachis hypogaea* L.) with chlorothalonil tolerant isolates of *Pseudomonas aeruginosa*. Plant Pathology 54 (3). In press.

**Kishore GK, Pande S and Podile AR. 2005b.** Biological control of collar rot disease with broad-spectrum antifungal bacteria associated with groundnut. Canadian Journal of Microbiology. 51: 123-132.

**Kishore GK, Pande S and Rao JN. 2002.** Field evaluation of plant extracts for control of late leaf spot in groundnut. Int. Arachis Newsletter. 22: 46-48.

**Pande S and Narayana Rao J. 2002.** Effect of plant population densities on the severity of late leaf spot and rust of groundnut. The plant pathology journal 18 (5): 271-278.

**Pande S, Mayee CD and Mc Donald. 1996.** Integrated management of groundnut diseases. Pages 285-304 in Plant Protection and Environment (Reddy DVR, Sharma HC, Gaur TB and Divakar BJ, eds.) Plant Protection Association of India, Rajendranagar, Hyderabad, Andhra Pradesh 500 030, India.

**Pande S and Rao JN. 2001.** Resistance of *wild Arachis* species to late leaf spot and rust in greenhouse trials. Plant Dis. 85:851-855.

**Pande S, Rao JN, Upadhyaya HD and Lenne JM. 2001.** Farmers' participatory integrated management of foliar diseases in groundnut. International Journal of Management 47(2): 121-126.

**Podile AR and Kishore GK. 2002.** Biological control of peanut diseases. In Biological control of crop diseases (Gnanamanickam SS, ed.). Marcel Dekker Inc. 131-160 pp.

**Reddy PS. 1982.** Production technology for groundnut Indian farming. 32:27-35.

**Sawant G G. 2000.** Relative efficacy of number of sprays of mancozeb 75 WP and carbendazim 50 WP against tikka/leaf spot disease of groundnut. Ind. J. Environ. Toxicol. 10:90-92.

**Subrahmanyam P, McDonald D, Waliyar F, Reddy LJ, Nigam SN, Gibbons RW, Ramanatha Rao V, Singh AK, Pande S, Reddy PM and Subba Rao PV. 1995.** Screening methods and sources of resistance to rust and late leaf spot of groundnut. Information Bulletin No. 47. Patancheru, Andhra Pradesh, India: ICRISAT.

**Suresh G, Narasimhan NS, Masilamani S, Partho PD and Gopalakrishnan G. 1997.** Antifungal fractions and compounds from uncrushed green leaves of *Azadirachta indica*. Phytoparasitica. 25:33-39.

# Groundnut diseases and their management

---

**K Subrahmanyam<sup>1</sup>**

Groundnut cultivation in Andhra Pradesh, particularly in the district of Anantapur, plays a major economic role in the lives of resource-poor farmers. Nearly 800000 ha is under groundnut cultivation in the district. It provides not only high quality cooking oil and also nutritious fodder for cattle. It is well known that this crop is attacked by several pathogens. The economic damage occurs not only through losses in pod and fodder yields but also due to low quality of crop residue, which is caused by these diseases and which drastically reduces the digestibility of fodder. So, it is essential to understand the economic importance of these diseases and their control measures in order to obtain higher quality and quantity of residues.

## **Crown rot (*Aspergillus niger*)**

Moisture deficit stress favors this disease and it shows up 30 days after sowing. The fungus causes both seed and seedling rot, resulting in low plant stand. Rotting seeds are usually covered with black masses of spores. Infected seedlings rapidly wilt and die with black spores at the collar region and at cotyledons.

### ***Control measures***

Collecting and burning diseased plants is the best way to reduce the incidence of crown rot in the soil. Seed treatment with Thiram or Captan @ 2.5 g/kg seed reduces disease incidence.

## **Stem and pod rot (*Sclerotium rolfsii*)**

This disease occurs from the seedling to maturity stages of the crop. Undecomposed organic matter create favorable conditions for the disease. The fungus attacks the plants at the collar region and kills the plant or a few lateral branches. The fungus also attacks stems and pods. A whitish mycelial growth is seen around affected stems. Infected pods show brown colored lesions and get left in the soil when the crop is lifted at maturity.

---

<sup>1</sup> Scientist (Pathology), ARS, ANGRAU, Anantapur, Andhra Pradesh, India.

### ***Control measures***

Deep ploughing in the summer to eradicate viability of sclerotia. The removal and destruction of the affected plants helps in reducing the inoculum of the fungus. Seed treatment with Captan @ 2.5 g/kg seed reduces disease incidence.

## **Late leaf spot (*Phaeoisariopsis personata*)**

Generally, late leaf spot appears as black circular spots on leaves, around 60 days after sowing. Low temperature around 25°C and intermittent leaf wetness create favorable conditions for the disease. Under favorable conditions, the leaves defoliate leaving the bare stems. Under severe conditions, elongated lesions are also observed on stems.

### ***Control measures***

Removal and burning of diseased plants greatly helps control this disease. Use of disease resistant/tolerant cultivars along with an IDM package that includes one sprays at 60-75 days and followed by another after 15 days, Kavach @ 2 g/l of water or Bavistin @ 1 g/l of water and 200 l of spray fluid/acre. For early maturing cultivars like ICGV 91114, a spray at 65-70 days after sowing (DAS) controls the disease.

## **Rust (*Puccinia arachidis*)**

Generally, the disease appears at 60-75 DAS along with LLS. The fungus produces orange or brown color pustules on the underside of the leaf. These pustules coalesce and the leaves become dry and remain attached to the stem. The chlorophyll content of leaf is lost and photosynthesis is affected resulting in early maturity of the crop.

### ***Control measures***

Since the pathogen survives on groundnut plants, removal and burning of volunteer plants is necessary. Wherever possible, it is advisable to use resistant varieties like ICGV 89104, ICGV 91114, ICGV 92020 and ICGV 92093. Apply Kavach @ 2 g/l of water, or claxin @ 0.5 ml/l of water and spray 200 l of the chemical solution per acre.

## **Bud Necrosis (Peanut bud necrosis virus)**

This is a virus disease that spreads through thrips. Affected plants remain bushy and stunted in growth. Initial symptoms appear in the young tender leaves below the terminal bud; later the terminal bud becomes necrotic and rots. If

the disease occurs within one month after sowing, the whole plant dies. Leaflets produced on auxiliary shoots are reduced in size, mosaic with chlorosis.

#### ***Control measures***

Control of this disease is helped by maintaining optimum plant stand in the field. Intercropping with fast growing cereal crops like sorghum to avoid free movement of thrips is also conducive. The use of resistant cultivars such as ICGVs 86029, 86030, 86031 reduce losses caused by this disease.

### **Stem Necrosis (Tobacco streak virus)**

Stem necrosis is also a virus disease and is transmitted through thrips. The disease appears as black necrotic spots on young leaves. These later extend to petioles, stems and to the growing bud resulting in the death of the vegetative buds. If the disease occurs within 30 days of sowing, the stem becomes necrotic and the plant dies. In adult plants, the proliferation of branches appear at leaf axils and the leaves on these branches are reduced in size and appear chlorotic.

#### ***Control measures***

The virus survives on several weeds and sunflower plants. Parthenium is a major host for this virus. Removal of parthenium on bunds and in the field helps reduce disease incidence. Optimum plant stand in the field is also recommended and intercropping with fast growing cereal crops like sorghum to avoid free movement of thrips is beneficial.

# Groundnut aflatoxin and its management

---

Farid Waliyar<sup>1</sup> and S Veera Reddy<sup>2</sup>

Many agricultural commodities including cereals, oilseeds, spices and fruit nuts are vulnerable to infestation by fungi that produce secondary toxic metabolites called aflatoxins. *Aspergillus flavus* and *A. parasiticus* produce aflatoxin B<sub>1</sub>, B<sub>2</sub>, G<sub>1</sub> and G<sub>2</sub> in groundnut. Aflatoxin contamination in groundnut is a serious problem in groundnut growing areas of the world. Toxicologically, aflatoxins particularly aflatoxin B<sub>1</sub> (AFB<sub>1</sub>) is regarded as a quadruple threat, ie, as a potent toxin, a carcinogen, a mutagen and as an immuno-suppressive chemical entity. Aflatoxin contamination in groundnut has gained global significance due to its deleterious effects on human and animal health and its importance to international trade. According to Charmley et al. (1994), 25% of the world's food crops are affected by mycotoxins each year and groundnut suffered a loss of \$26 million in the USA alone. In groundnut, *A. flavus* infection and aflatoxin contamination occur at preharvest and postharvest stages and during storage.

## Effects of aflatoxin

**Plant health.** The quality of groundnut kernels deteriorates due to *A. flavus* infection. Severely mold-affected kernels become unfit for consumption. The fungus can cause pre-emergence of seed rot in the soil and aflatoxin causes aflatoxin root disease in young seed and lyso appear stunted with small pointed leaves.

**Human health.** AFB<sub>1</sub> induces liver cancer in several animal species, and has also been linked to liver cancer in human beings (Wang et al. 1996). Statistical correlations between contaminated food supplies and high frequencies of human hepatocellular carcinomas in Africa and Asia have implicated aflatoxins as risk factors in human liver cancer. All epidemiological studies of aflatoxins and liver cancer conducted in Africa and Asia involving populations subjected to hepatitis B virus (HBV) infection indicates possible synergistic effect of aflatoxins and HBV infection in the etiology of liver cancer (Montesano et al. 1997; Groopman and Kensler 1996). Aflatoxin causes impaired growth in children, notably in Africa and childhood cirrhosis in India. One of the most important accounts of aflatoxicosis in humans occurred in 150 villages in northwest India in the fall of 1974. About 397 persons were affected and 108 persons were reported to

---

<sup>1</sup> Principal Scientist (Pathology), ICRISAT, Patancheru, Andhra Pradesh, India.

<sup>2</sup> Scientific Officer, ICRISAT, Patancheru, Andhra Pradesh, India.

have died in the outbreak, due to contaminated corn, where aflatoxin levels of 0.25 to 15 mg/kg were found. Recently, about 120 people died in Kenya due to intake of aflatoxin-contaminated maize.

**Livestock health.** All animal species are susceptible to aflatoxicosis, although sensitivity varies considerably from species to species. For example, birds, fish, dogs, and swine appear to be more susceptible than mature cattle. In poultry, besides fatty liver and kidney disorders, leg and bone problems can develop as well as outbreaks of coccidiosis. Aflatoxins may cause vaccines to fail, increase birds' susceptibility to disease resulting in suppression of the natural immunity to infection. Animals become susceptible to infection by bacteria such as *Salmonella* and to various viruses and other infectious agents commonly found around the farmyard, feedlot or poultry house that normal healthy animals ward off. Decreased blood clotting results in a greater downgrading and condemnation of birds because of massive bleeding and bruises. Less carcass pigmentation is exhibited and egg yolks become pale. The hatchability of eggs can drop, and reduced production may be noted as well as smaller eggs with shell problems. Growth is restricted and mortality increases, especially during the growing period.

Several outbreaks of aflatoxicosis in cattle have been reported. The lesions were confined mainly to the liver, showing degenerative changes with biliary proliferation and finally leading to diffuse cirrhosis. Regular or occasional consumption of feed containing aflatoxin in the range of less than 100 parts per billion (ppb) to a few hundred parts per million (ppm) by farm animals result in decreased feed consumption, poor feed conversion, stunting and decreased flesh growth. Decreased productivity may be accompanied by damage to the liver, hemorrhaging into the muscles or body cavities, and suppression of natural immunity. Once the damage has been done the animal cannot fully recover, even if returned to a toxin-free ration.

**Aflatoxin in milk.** Aflatoxin M1 (AFM1) is major metabolite of aflatoxin B1 found in milk of animals that have consumed feeds contaminated with aflatoxin B1. Toxic and carcinogenic effects of AFM1 have been convincingly demonstrated in laboratory animals and therefore AFM1 is classified as class 2B human carcinogen. AFM1 is relatively stable during pasteurization, storage and preparation of various dairy products; and therefore AFM1 contamination poses a significant threat to human health especially to children, who are major consumers of milk. Analysis of milk samples from different regions of Andhra Pradesh indicated that AFM1 contamination was greater in peri-urban samples than rural samples. The major feed ingredients for cattle in peri-urban areas of Hyderabad city are cotton cake, groundnut cake, rice bran and straw. A majority of cotton and groundnut cake samples contained aflatoxin levels exceeding 500 µg/kg. In rural areas of Anantapur, the majority of farmers feed their animals with green grass, straw, groundnut and haulms. Groundnut haulms with small pods were found to contain high levels of aflatoxins.

## International trade

Since aflatoxins affect human as well as animal health, countries importing relevant commodities have imposed regulations on permissible limits, ie, 4 to 50 µg/kg of aflatoxin in food and feeds. The economic implications of aflatoxin and its potential health threat to human as well as livestock clearly created a need to eliminate or reduce aflatoxins contamination in food and feed.

## Management

Aflatoxin management options include:

- Resistant cultivars
- Cultural practices
- Biological control
- Integrated management

**Resistant cultivars.** The best way to control or reduce aflatoxins contamination is by growing resistant cultivars. Unfortunately cultivars with good agronomic background, resistant to aflatoxin contamination are not available. Fourteen aflatoxin resistant/tolerant groundnut lines were tested through the farmer participatory approach in Anantapur and Chittoor districts, Andhra Pradesh. Two varieties, ICGVs 94379 and 94434, produced 25-40% higher pod yield in farmer fields with comparatively lesser aflatoxin contamination than local cultivars.

**Cultural practices.** Cultural practices such as summer ploughing, sowing at the right time, seed treatment with Mancozeb and chloropyrifos, gypsum application, removal of premature dead plants, managing pest and diseases, harvesting at the right time, quick pod drying, controlling storage pests and storing the pod/seed with <10% moisture help reduce aflatoxin contamination.

**Biological control.** Various bio-control agents such as non-toxigenic *Aspergillus flavus*, *Trichoderma viride*, *Trichoderma harzeanum* were reported to be effective in reducing the seed infection by *A. flavus* and aflatoxin contamination. Application of *Trichoderma viride*, a bio-control agent along with the cultural practices is effective in reducing *A. flavus* population in soil upto 65%, seed infection up to 75% and aflatoxin contamination upto 80% in on-farm trials.

**Integrated management.** Integration of host plant resistance with cultural practices and bio-control agents helps minimize *A. flavus* seed infection and reduce aflatoxin contamination in groundnut. Currently, trials on integrated management are in progress.

## References

**Charmley LL, Rosenberg A and Trenholm HL. 1994.** Factors responsible for economic losses due to *Fusarium* mycotoxin contamination of grain, foods and feedstuffs. *In* Mycotoxins in Grains (Miller JD and Trenholm HL, eds.). St. Paul, MN: Eagan press. 471 pp.

**Groopman JD and Kensler W. 1996.** Temporal patterns of aflatoxin-albumin adducts in Hepatitis B surface antigen-positive and antigen-negative residents of Daxin, Qidong county, People's Republic of China. *Cancer Epidemiology Biomarkers and Preventions* 5:253-256.

**Montesano R, Hainaut P and Wild CP. 1997.** Hepatocellular carcinoma: From gene to public health. Review, *Journal of National Cancer Institute*, 89:1844-1851.

**Wang LY, Hatch M, Chen CJ, Levin B, You SL, Lu SN, Wu M H, Wu WP, Wang LW, Wang Q, Huang GY, Yang PM, Lee HS and Santella RM. 1996.** Aflatoxins exposure and risk of hepatocellular carcinoma in Taiwan. *International Journal of Cancer*, 67: 620-625.

# Groundnut insect pests and their management

---

NC Venkateswarlu<sup>1</sup>

Insect pests are one of the main constraints that affect groundnut productivity. Among the several insects attacking groundnut, only a few are economically important. Depending upon how they feed on groundnut foliage, they are grouped as: (i) leaf eating insects, (ii) sucking insects and (iii) those attacking roots and pods. Red hairy caterpillar, semilooper and leaf miner belong to the first category. Thrips, jassids, aphids and mites are important sucking pests, while white grubs and termites cause severe damage to roots and pods. However, they are very sporadic in nature.

## Red hairy caterpillar (*Amsacta albistriga*)

This is a highly sporadic pest and can be devastating. The moth has brown striped wings on a white body. These insects diapause in their pupal stage in the soil and they emerge soon after the first showers in June/July. They also lay eggs on weeds and ber (*Ziziphus* spp.) plants on the field bunds and boundaries. Each female lays about 500 to 1500 eggs on the underside of the leaflets.

### *Control measures*

- Deep tillage in summer exposes diapausing pupae, which are killed due to solarization. The exposed insects also become prey to birds.
- In case deep ploughing is not done, the adults come out roughly 48 hours after the first rain. To counter this, bonfires must be lit in the evening between 7 pm and 10 pm: this causes the adult moths (which are attracted to the fire) to perish in large numbers. Farmers ideally must come together and light bonfires in pre-arranged places for maximum efficiency. Insects that may not have perished must be handpicked and destroyed. On the following morning, it is recommended to keenly observe the leaves of plants in the surrounding areas and destroy egg clusters that may have been missed. These measures succeed in limiting damage by the red hairy caterpillar by upto 90%.
- Neem oil can also be sprayed within three days of egg laying because the eggs hatch in 3-4 days. Farmers must take care to destroy eggs not only on groundnut leaves but also on weeds and bushes. Infestation tends to appear like a patch of starch on a white cloth, and eggs and small insects can be

---

<sup>1</sup> Scientist (Entomology), ARS, ANGRAU, Anantapur, Andhra Pradesh, India.

seen under the leaf. If this is observed on groundnut leaves, it indicates that infestation of the crop has begun. Even so, in early stages, infected leaves can be handpicked and destroyed.

- As a last alternative, common pesticides like quinalphos or monocrotophos can be sprayed (2ml/l and 200 l spray fluid/acre) when the insect is very small (1-2 instar). Beyond this stage, it is difficult to control the insect as the larvae develop a lot of hair preventing the insecticide coming into contact with their skin. Once the 3<sup>rd</sup> instar stage is crossed, handpicking of caterpillars is the only way to save the crop. Also, a plough furrow around the field filled with insecticidal dust (Folidol 2%) will prevent migration of the insect from field to field.

### **Semilooper (*Plusia* spp.)**

This insect also lays its eggs in masses. The integrated crop protection methods to combat this insect are well known and greatly contribute to its control in the early stages. Once the larvae grow bigger, however, the pest is difficult to control.

### **Leaf miner (*Aproaerema modicella*)**

This species is the biggest pest of groundnut in many parts of southern India. The adult is a brownish grey moth. Shiny white eggs are laid singly, usually on the under surface of leaflets. Each female moth can lay upto 200 eggs. The young larvae mine into the leaves as soon as they hatch. When the mine is opened, the minute caterpillar inside become visible. When the larvae become too large to occupy the mine, they emerge and web adjacent leaflets together and continue to feed on leaf tissue from inside. A severely attacked field looks 'burnt' from a distance. Epidemics can result in total crop loss.

### **Control measures**

Insecticides, preferably dimethoate @ 200-250 ml active ingredient/ha or monocrotophos @ 150-200 ml active ingredient/ha -should be applied if clouds of groundnut leaf miner moths are seen flying in the cropped area when disturbed, or as soon as the first mines are noticed. Chemical control is recommended if five or more active larvae/plant are found about 30 days after seedling emergence (DAE), 10 larvae/plant at 50 DAE, or 15 larvae/plant at 75 DAE or later.

The role of natural enemies must be considered before chemical spraying. For instance, if more than 50% of the larvae are parasitized (parasites can seem to appear like minute white specks, no more than 1 mm long, attached to the outside of the larvae), it is advisable to postpone the spray, and closely monitor the development of the pest population.

### **Mites (*Tetranychus* spp.)**

Mites attack when atmospheric temperature is low. These spear shaped small creatures are seen on leaves, buds and tender stems. When they are tiny, they are light green in color and have a crawling movement. As they grow, they become darker. When the attack is intense, the plant may be invaded by many fungi. As a result, much of the chlorophyll content is reduced, photosynthesis is affected and the growth of the plant is arrested.

Farmers are also advised to look out for ladybird beetles, which are natural predators to mites. The larvae of this beetle looks like a caterpillar and eats the mites. If these beetles are seen in abundance, it might be unnecessary to spray. If they are not in adequate numbers to check mites, however, 2 ml of rogor in 1 l water or 1.6 ml of monochrotophos in 1 l of water can be sprayed.

**Session II: Farmers' participatory  
on-farm Integrated Disease  
Management in groundnut**

---



# Influence of IDM on groundnut yields in the Deccan Plateau, Andhra Pradesh

---

S Pande<sup>1</sup>, J Narayana Rao<sup>2</sup>, P Lakshmi Reddy<sup>3</sup>  
and G Krishna Kishore<sup>4</sup>

## Introduction

Groundnut (*Arachis hypogaea* L.) is a valuable source of protein and provides high quality cooking oil. Its crop residue (haulm) is widely used as fodder for dairy cattle and buffalo in Andhra Pradesh in the Deccan Plateau. Several diseases influence the quantity (yield) and quality (nutritive value) of groundnut residue.

Among fungal diseases, late leaf spot (LLS) [*Phaeoisariopsis personata*] and rust (*Puccinia arachidis*) - together called foliar diseases - are the major constraints for groundnut production (Pande et al. 2001). Early leaf spot (*Cercospora archidicola*) also attacks the crop and causes severe losses in haulm and pod yield. Important soil-borne fungal diseases that affect the quality and quantity of groundnut haulms and pods include stem and pod rots (*Sclerotium rolfsii*), collar rot (*Aspergillus niger*) and aflatoxin contamination (*Aspergillus flavus*). The incidence of stem and pod rots is increasing alarmingly in groundnut growing areas of this region.

Generally foliar diseases occur together and cause > 70% losses in the quality and quantity of haulms and pods in the region. Increased milk production in peri-urban areas of the Plateau will require greater quantities of higher quality crop residue.

In Andhra Pradesh, groundnut is the second major source (14 million tons) after sorghum of feed for livestock. Approximately 0.8 million ha fall under groundnut production every year in the district of Anantapur. The local variety commonly grown in this district produces very poor quality haulms due to foliar diseases every year. It is believed that disease-affected fodder has low digestibility and fetches lower prices in the fodder markets resulting in substantial reduction in the incomes of the resource-poor farmers (Ramadevi et al. 2000).

Foliar disease management in groundnut often involves indiscriminate use of chemicals or total reliance on host plant resistance. We attempted to develop and validate an effective Integrated Disease Management (IDM) technology

---

<sup>1</sup> Principal Scientist (Pathology), ICRISAT, Patancheru, Andhra Pradesh, India.

<sup>2</sup> Senior Scientific Officer (Pathology), ICRISAT, Patancheru, Andhra Pradesh, India.

<sup>3</sup> Senior Scientist (Pathology) and Coordinator, DAATTC, ANGRAU, Anantapur, Andhra Pradesh, India.

<sup>4</sup> Visiting Scientist (Pathology), ICRISAT, Patancheru, Andhra Pradesh, India.

consisting of a combination of available moderate levels of host plant resistance with high yield background and judicious application of chemical fungicides. Results obtained from on-station IDM trials at ICRISAT-Patancheru indicated that significantly high quantity and quality of haulm and pod yields were obtained from control plots when compared to non-IDM plots (Pande et al. 2003). Healthy or less-diseased haulms were found to be better digested than diseased haulms (Sivaiah et al. 2003).

The objectives of the present study were:

1. To develop economically feasible IDM technology for the management of late leaf spot and rust diseases of groundnut, and
2. To evaluate and promote IDM technology and its components through participatory on-farm research in Anantapur.

## **Materials and methods**

### **Development of IDM technology**

On-station experiments to develop an economically feasible IDM technology package in groundnut was conducted in an Alfisol field at an experimental farm at ICRISAT, Patancheru during 1999-2000. Seven cultivars, ICGVs 89104, 91114, 92267 (early-maturing), 92020, 92093, 94080 (medium-maturing) and TMV 2 (similar to local cultivar) were included in this experiment. The two treatments comprised Integrated Disease Management (IDM) and no management (non-IDM). The design of the experiment was split-plot with treatments as main plots and cultivars as sub-plots with three replications.

The components of IDM studied in these experiments were: improved cultivar with partial resistance to foliar diseases, fungicide seed treatment with a mixture of Bavistin and Thiram (1:1) @ 2 g/kg seed and economical use of one or two foliar applications of fungicide, Kavach, at 60 DAS for early-maturing cultivars (one spray) and one spray each at 60 and 75 DAS for medium-maturing cultivars. None of the inputs of IDM were given to the non-IDM plots. The experiment was repeated twice. At harvest, the dried (50°C) sample haulms from all the cultivars were analyzed for *in vitro* digestibility by an animal nutritionist.

Severity of foliar diseases (both LLS and rust) was scored at 10-day intervals from 45 DAS till maturity on a 1-9 rating scale where 1 = no disease and 9 = maximum disease, with all leaves defoliated (Subrahmanyam et al. 1995).

### **Farmers' participatory on-farm evaluation of IDM technology**

IDM technology was evaluated through farmers' participatory on-farm research in farmers' fields in Anantapur. The on-farm research was conducted

in collaboration with the District Agricultural Advisory and Transfer of Technology Centre (DAATTC), Agricultural Research Station (ARS), Acharya NG Ranga Agricultural University (ANGRAU), and Rural Development Trust (RDT), Anantapur. During 2001, IDM technology was evaluated in the fields of 21 farmers in the village Jambuladinne, and in 2002, with 80 participating farmers in two villages, Danduvaripalli and Rekulakunta. The year 2003 had 70 farmers from two villages, Gummallakunta and Jalalapuram, and 2004 had 150 participating farmers from five villages, Lingareddypalli, Jalalapuram, Jonnalakothapalli, Talupuru and Antaraganga. The selection of villages and participating farmers followed the guidelines suggested by Pande et al. (2001).

Farmer orientation field schools were conducted in each village to educate selected farmers on major production constraints and their timely management. Brochures were prepared in Telugu, the local language, and distributed to all participating farmers during orientation. These schools were organized three times during the season, one before planting and the others at 30 to 40 days and at 60 to 70 days after sowing. During the first class, farmers were encouraged to share their experiences and perceptions about groundnut production constraints. Then they were told about the concept driving IDM. In the second and third classes, more detail was given on symptoms and losses caused by foliar diseases, favorable weather conditions for the development of these diseases, the time of their appearance and management options.

Two trials - participatory varietal selection (PVS) trials with seven cultivars during the rainy seasons of 2001 and 2002 and IDM trials with ICGV 91114 during the rainy seasons of 2001 to 2004 - were conducted in these selected villages. The PVS trial was conducted to verify the cultivar's superior adoptability in the region.

**PVS trial.** Six groundnut cultivars that were moderately resistant to foliar diseases and one local cultivar were evaluated in these trials. The six cultivars were: ICGVs 89104, 91114, 92267 (early-maturing); ICGVs 92020, 92093, 94080 (medium-maturing), and the local cultivar used was TMV 2. The evaluations took place in the fields of five farmers in, Jambuladinne during 2001, and in 10 farmers' fields in Danduvaripally and Rekulakunta in 2002. Each cultivar was sown in about 500 m<sup>2</sup> in a strip plot design in each trial. After sowing, each cultivar was divided into two halves in each trial with IDM in one half and non-IDM in the other.

**IDM trial.** Dual-purpose groundnut cultivar ICGV 91114 was included in this IDM trial for all the years. About 16 trials in 2001, 70 trials each in 2002 and 2003, and 150 trials in 2004 were conducted in selected villages. Each trial was planted in about 2000 sq m (half an acre) with IDM technology and compared with the non-IDM treated local cultivar for quantity and quality of haulms and pods.

# Results

## Development of IDM technology

The severity of LLS received a 4 to 5 rating on a 1-9 rating scale in IDM and around 5-9 in the non-IDM section in all cultivars. Significantly, lower severity of LLS was recorded in all improved cultivars in IDM plots when compared to TMV 2 of non-IDM plots. Similarly, severities of rust were significantly lower in IDM plots in all cultivars (Table 1). Significantly, higher haulm (residue) and pod yields were obtained in all cultivars in IDM plots than in non-IDM plots. Haulm yields were significantly higher in all improved cultivars with IDM treatment than in the case of TMV 2 with non-IDM treatment (Table 2). *In vitro* analysis of haulms indicated that percent digestibility was significantly high in all improved cultivars in IDM plots compared to non-IDM plots.

Among the improved cultivars, ICGVs 89104, 91114, 92020 and 92093 were selected as they had superior digestibility under *in vitro* analysis (Table 3) and hence were included in farmers' participatory on-farm trials.

**Table 1. Effect of Integrated Disease Management on severity of late leaf spot (LLS) and rust in selected groundnut cultivars, ICRISAT-Patancheru, 1999-2000.**

Cultivar	Disease score*			
	LLS		Rust	
	IDM	Non-IDM	IDM	Non-IDM
ICGV 89104	5.0	9.0	5.3	7.7
ICGV 91114	4.7	9.0	5.0	7.7
ICGV 92267	5.0	7.3	4.7	7.0
ICGV 92020	4.3	6.0	2.0	2.0
ICGV 92093	4.3	4.3	2.0	2.3
ICGV 94080	4.0	5.7	3.3	5.3
TMV 2	5.0	9.0	5.3	7.7
LSD 5%		0.56		0.471

\*On a 1-9 rating scale.

IDM = Integrated disease management with improved cultivar, fungicide seed treatment and economical application of one or two sprays of fungicide Kavach (chlorothalonil).

Non-IDM = No IDM inputs; traditional treatment.

**Table 2. Effect of Integrated Disease Management on haulm and pod yields of selected groundnut cultivars, ICRISAT, Patancheru, 1999-2000.**

Cultivar	Yield t/ha			
	Haulm		Pod	
	IDM	Non-IDM	IDM	Non-IDM
ICGV 89104	2.05	1.35	1.37	0.85
ICGV 91114	2.15	1.40	1.50	0.90
ICGV 92267	1.99	1.35	1.44	0.83
ICGV 92020	3.10	2.34	2.17	1.85
ICGV 92093	3.35	2.75	2.11	1.76
ICGV 94080	3.10	2.25	1.97	1.54
TMV 2	1.76	0.98	1.10	0.75
LSD 5%		0.136		0.108

**Table 3. Effect of Integrated Disease Management on the *in vitro* digestibility of haulms of selected groundnut cultivars, 1999-2000.**

Cultivar	Digestibility %	
	IDM	Non-IDM
ICGV 89104	65.6	60.3
ICGV 91114	68.7	61.0
ICGV 92267	64.8	59.1
ICGV 92020	70.2	66.8
ICGV 92093	73.3	68.8
ICGV 94080	71.4	67.9
TMV 2	67.3	56.9
LSD 5%		2.34

## Farmer's participatory on-farm evaluation of IDM technology

Drought was severe during 2001, 2002 and moderate in the 2003 rainy seasons in all targeted villages in the district. Supplementary irrigation was given to approximately 50% of the trials in each village and data was collected from these trials during the drought years.

**PVS trial.** Severity of foliar diseases was significantly lower (3.0 - 5 rating on 1-9 rating scale in both 2001 and 2002) in IDM plots compared to non-IDM plots (4-7.5 rating) for all improved cultivars as against TMV 2 and the

local cultivar. All the improved cultivars had significantly low severity of foliar diseases than TMV 2 and the local cultivar in non-IDM plots (7.5-8.5 rating) as well. Severity of foliar diseases was significantly lower in medium-maturing cultivars than in early-maturing cultivars in both years. Haulm and pod yields were very poor during 2001 compared to 2002, across all the trials in both treatments, because of drought. Haulm and pod yields were significantly higher in all improved cultivars with IDM treatment than in the local cultivar with non-IDM treatment (Tables 4 and 5). Among the cultivars of the PVS trial, ICGV 91114 was most preferred by farmers as it had traits (pod shape, size and seed color, oil content and percent shelling) acceptable to them. Moreover, this variety matures in 95 DAS with high yield potential, tolerance to drought and has good market value.

**Table 4. Severity of foliar diseases LLS and rust in farmers' participatory varietal selection trials, Anantapur, 2001-2002.**

Cultivar	Foliar diseases (LLS and rust) score*			
	2001		2002	
	IDM	Non-IDM	IDM	Non-IDM
ICGV 89104	5.0	7.5	5.3	7.7
ICGV 91114	5.0	7.0	5.0	7.7
ICGV 92020	3.0	4.0	3.3	4.5
ICGV 92093	3.0	4.0	3.0	3.5
TMV 2	6.0	7.0	6.3	7.7
Local cultivar	7.0	8.5	7.5	8.5
LSD 5%	0.42		0.58	

\* On a 1-9 rating scale.

**IDM trial.** Since the early-maturing ICGV 91114 gained farmers' favor, it was included in IDM trials in several villages in Anantapur. In the initial trials, few farmers understood the advantages of this variety, particularly its nutritive haulms and tolerance to foliar diseases. They noted an increase in milk yield by feeding cattle with haulms of this cultivar. Severity of foliar diseases in ICGV 91114 ranged from 3 - 5 in IDM plots compared to 5 - 6.5 rating in local cultivar of non-IDM plots. Haulm and pod yields were higher in IDM plots than non-IDM plots. Though the haulm and pod yields were low in 2001 and 2002, compared to the average production during the previous years, ICGV 91114 recorded significantly higher yields than the local cultivar with non-IDM treatment (Table 6).

**Table 5. Effect of Integrated Disease Management on haulm and pod yields in farmers' participatory varietal selection trials, Anantapur, 2001-2002.**

Cultivar	Yield/ha							
	Haulm				Pod			
	2001		2002		2001		2002	
	IDM	Non-IDM	IDM	Non-IDM	IDM	Non-IDM	IDM	Non-IDM
ICGV 89104	1.29	0.97	1.93	1.54	0.78	0.59	1.35	1.13
ICGV 91114	1.38	1.04	2.12	1.85	0.82	0.64	1.59	1.32
ICGV 92020	1.67	1.33	3.45	2.50	1.00	0.83	2.35	1.81
ICGV 92093	1.66	1.31	3.15	2.35	0.87	0.74	2.23	1.90
TMV 2	1.36	0.82	1.75	1.20	0.75	0.54	1.10	0.78
Local cultivar	1.14	0.74	1.60	1.02	0.65	0.44	1.05	0.70
LSD 5%	0.15		0.18		0.13		0.16	

**Table 6. Performance of dual-purpose groundnut cultivar, ICGV 91114, in participatory on-farm Integrated Disease Management trials, Anantapur, 2001-2004.**

Year	Village	Foliar disease score*		Yield t/ha			
		IDM	Non-IDM	Haulm		Pod	
		IDM	Non-IDM	IDM	Non-IDM	IDM	Non-IDM
2001	Jambuladinne	5.0	6.3	1.69	1.33	0.96	0.55
2002	Danduvaripalli	4.0	6.0	1.50	1.15	0.56	0.35
	Rekulakunta	3.7	6.0	1.35	1.10	0.50	0.40
2003	Gummallakunta	5.0	7.0	2.10	1.75	1.85	1.0
	Jalalapuram	4.7	6.5	2.25	1.80	2.00	1.35
2004	Jalalapuram	5.0	6.4	3.14	2.14	1.95	1.45
	Lingareddypalli	4.3	5.7	2.90	2.01	2.10	1.35
	Jonnalakothapalli	4.7	6.3	3.10	2.27	2.10	1.41
	Talupuru	4.5	6.0	2.81	1.95	2.20	1.40
	Antaraganga	4.3	5.7	2.95	1.80	1.95	1.22

\* On a rating scale of 1-9.

## Establishment of the village level seed system

Seed is an important component of farming in rural households in the Deccan Plateau. In districts like Anantapur where approximately 0.8 million ha of groundnut are grown every year with a narrow multiplication ratio (1:5) and heavy seed rate, ie, the recommended seed quantity for sowing, no single agency can meet the demand for seed. Some of the seed needs are met from government and non-government agencies in the district and the rest from neighboring districts but with poor quality of seed. If new cultivars are to be adopted successfully by farmers, availability of quality seed within accessible distance is essential. Therefore, a village level farmer participatory seed multiplication system was established successfully to provide quality seed of the new dual-purpose cultivars in the district. Cultivar ICGV 91114 was most preferred by farmers, and its demand exceeds supply. To meet this requirement, 25 enthusiastic farmers/self-help groups in five villages were identified to multiply the seed during the 2004/05 postrainy season (Table 7).

**Table 7. Uptake of ICGV 91114 for seed increase in the postrainy season of 2004-05, Anantapur.**

Village	No. of farmers	Area	Yield (q/ac)
Jalalapuram	6	8	64
Lingareddypalli	10	12	100
Talupuru	5	10	76
Gummallakunta	3	5	40
Jonnalakothapalli	2	3.5	28

## Discussion

In the Deccan Plateau, crop residues are very important sources of fodder for cattle and buffalo. Adequate nutrition is essential for livestock production, which is an integral part of mixed crop-livestock system in this region. Groundnut haulms are the second major source of fodder after sorghum in Andhra Pradesh. Pande et al. (2001) reported that foliar diseases (LLS and rust) were the major constraints for groundnut production. Both these diseases occur together and reduce the quantity and quality of residue drastically in this region. The adverse effects of these foliar diseases on the quantity and quality of residue and pods were confirmed through the present study. In the present study, severity of foliar diseases was significantly lower in IDM plots. These results are in agreement with results obtained by Pande et al. (1998, 2001). Pande et al. (1998) reported that lower severities of foliar diseases of improved cultivars in IDM plots yielded higher quantities of haulms and pods than the

local cultivar from non-IDM plots in farmers' participatory on-farm studies. Similar results of higher haulm and pod yields were obtained from improved cultivars in IDM plots than from local cultivars of non-IDM plots in all trials. The low haulm and pod yields of cultivar ICGV 91114 during 2001 and 2002 was due to severe drought in the selected villages but still its performance is relatively better than all the others under testing.

Management of foliar diseases in groundnut by adopting IDM technology in both on-station and on-farm farmers' participatory IDM trials yielded higher quantities as well as high quality nutritive fodder (Pande et al. 2003). Higher quantities and quality residue were also obtained in the present study. Thus IDM technology developed at ICRISAT-Patancheru helps resource-poor farmer obtain higher quantities of haulm and pod and also high quality nutritive feed for cattle and buffalo. This in turn leads to increased milk yield and helps augment their income in a sustainable way.

## References

- Pande S, Narayana Rao J, Lenne JM, Srinivas B, Johnson M, Ramana Reddy AV and Gopal Reddy G. 1998.** On-farm evaluation of groundnut foliar disease management technologies in the state of Andhra Pradesh, India. *International Arachis Newsletter*. 18: 47-48.
- Pande S, Narayana Rao J, Upadhyaya HD and Lenne JM. 2001.** Farmers' participatory integrated management of foliar diseases in groundnut. *International Journal of Pest Management*. 47 (2): 121-126
- Pande S, Blummel M, Sivaiah K and Narayana Rao J. 2003.** Effect of diseases on yield and nutritive quality of groundnut and sorghum crop residues. Pages 29-35 *in* Evaluation of effect of plant diseases on yield and nutritive value crop residues used in peri-urban dairy production on the Deccan Plateau of India (Pande S and Parthasarathy Rao P, eds.). Summary proceedings of a workshop, 19-22 February 2003, ICRISAT, Patancheru, India. 55 pp.
- Pande S, Bandyopadhyay R, Blummel M, Narayana Rao J, Thomas D and Navi SS. 2003.** Disease management factors influencing yield and quality of sorghum and groundnut crop residues. *Field Crops Research* 84:89-103.
- Rama Devi R, Bandyopadhyay R, Hall AJ, Indira S, Pande S and Jaiswal P. 2000.** Farmers' perceptions of the effects of plant diseases on the yield and nutritive value of crop residues used for peri-urban dairy production on the Deccan Plateau: Findings from participatory rural appraisals. *Information Bulletin* no. 60. Patancheru, Andhra Pradesh, India: ICRISAT.
- Sivaiah K, Ramteke, Ramchandra and Pande S. 2003.** Effects of feeding healthy and diseased jawar straw and groundnut haulms on voluntary dry matter intake and nutrient utilization in buffaloes. Pages 19-22 *in* Evaluation of effect of plant diseases on yield and nutritive value crop residues used in peri-urban dairy production on the Deccan

Plateau of India (Pande S and Parthasarathy Rao P, eds.). Summary proceedings of a workshop, 19-22 February 2003, ICRISAT, Patancheru, India. 55 pp.

**Subrahmanyam P, Mc Donald D, Waliyar F, Reddy LJ, Nigam SN, Gibbons RW, Ramanatha Rao V, Singh A K, Pande S, Reddy PM and Subba Rao PV. 1995.** Screening methods and sources of resistance to rust and late leaf spot of groundnut. Information Bulletin no. 47. Patancheru, Andhra Pradesh, India: ICRISAT.

# Farmers' participatory crop and disease management in groundnut in Anantapur

---

P Lakshmi Reddy<sup>1</sup> and K Ankaiah Kumar<sup>2</sup>

Late leaf spot (LLS) (*Phaeoisariopsis personata*) and rust (*Puccinia arachidis*) are two of the most critical and destructive diseases in groundnut. Economic losses to farmers are heavy as well. According to estimates, these diseases cause upto 70% losses in pods and upto 90% in haulms. These then are the major biotic constraints in the production of groundnut in Anantapur district, where the crop is cultivated in more than 0.8 million ha annually. These foliar diseases can be effectively managed by using Integrated Disease Management (IDM), a package developed at ICRISAT

## Integrated Disease Management

Integrated Disease Management (IDM) is defined as "The optimization of disease control measures in an economically and ecologically sound manner accomplished by the coordinated and conjunctive use of multiple tactics to assure stable crop production and to maintain pathogen damage below the economic injury level to humans, animals, plants and environments" (Jesen 2000). On-station IDM trials at ICRISAT, Patancheru, have clearly demonstrated that when moderate levels of resistance are combined with affordable levels of chemical control, expected yields and economic returns are higher than with susceptible genotypes. Accordingly, IDM technology consisted of an improved cultivar with partial resistance to foliar diseases, seed treatment with a mixture of fungicides ie, Thiram and Bavistin 1:1 @ 2 g/kg seed and economical use of one or two foliar applications of fungicide Kavach (Chlorothalonil) at 60 days (one spray) for early maturing cultivars and at 60 and 75 days after sowing for medium maturing cultivars.

The IDM technology was evaluated, validated and promoted through on-farm research in collaboration with Agricultural Research Station (ARS), Rural Development Trust (RDT) and District Agricultural Advisory and Transfer of Technology Centre (DAATT Centre) during 2001-2004 (Table 1). In these participatory trials, IDM technology with four genotypes ICGV 89104, ICGV 91114 (short duration 95 days), ICGV 92020, ICGV 92093 (medium duration 125 days) was evaluated and compared with local cultivars in nine

---

<sup>1</sup> Senior Scientist (Pathology) and Coordinator, DAATT Centre, ANGRAU, Anantapur, Andhra Pradesh, India.

<sup>2</sup> Scientist (Extension), DAATT Centre, ANGRAU, Anantapur, Andhra Pradesh, India.

**Table 1. Locations of groundnut on-farm I D M trials in Anantapur district, 2001-2004.**

Year	Village	Mandal
2001	Jambuladinne	Garladinne
2002	Rekulakunta	BK Samudram
2002	Danduvaripalle	BK Samudram
2003	Gummallakunta	Bathalapalli
2003	Jalalapuram	Bathalapalli
2004	Jalalapuram	Bathalapalli
2004	Lingareddypalli	Bathalapalli
2004	Jonnalakothapalli	Mudigubba
2004	Talupuru	Atmakur
2004	Antaraganga	Kuderu

villages in Anantapur district (Table 2). Foliar diseases (LLS and rust) severities remained low ( 5 rating on 1-9 scale in IDM plots) while it was 7 rating in non-IDM plots in all the cultivars in all locations. Pod and haulm yields were higher in IDM plots of all improved cultivars than in non-IDM plots with local cultivars. Of the four improved cultivars, ICGV 91114 being an early maturing cultivar was liked and preferred by most farmers.

**Table 2. Characteristics of groundnut cultivars included in IDM trials in 90-95 days after sowing (DAS); Anantapur district, 2001-2004.**

Cultivar	Characteristics
ICGV 91114	Moderately resistant to LLS and rust; matures in 90-95 days after sowing (DAS); shelling 70%; pod yield 2.5 t/ha
ICGV 89104	Moderately resistant to LLS and rust, and resistant to aflatoxin contamination; matures in 90-95 DAS; shelling 68%; pod yield 2.5 t/ha
ICGV 92020	Moderately resistant to LLS and rust, tolerant to drought; matures in 125-130 DAS; shelling 68%; pod yield upto 3.5 t/ha
ICGV 92093	Moderately resistant to LLS and rust; matures in 125-130 DAS; shelling 70%; yield upto 3 t/ha
Local cultivar (TMV 2)	Locally adopted material of mixed identity; susceptible to LLS and rust; matures in 110-115 DAS, shelling 60%; pod yield around 0.5 to 0.8 t/ha

## **Farmers' perceptions**

Farmers by and large seem to favor ICGV 91114 because of its responsiveness to IDM, earliness, drought tolerance, partial resistance to LLS and high pod and haulm yields. Further the fodder is exceptionally good in terms of quality and quantity and higher milk yield was recorded when fed to animals. There is also appreciable reduction in cost of cultivation and a better benefit: cost ratio. These are some farmer reactions to ICGV 91114 and its IDM components:

### **1. Challa Bhaskar, Lingareddypalli, Bathalapalli mandal**

ICGV 91114 is excellent, and produces 10 bags (40 kg each) from 1 bag seed as against 6 bags of produce with JL 24. Moreover, it yields higher quantities of fodder than the local cultivar.

### **2. P Dastagiri Reddy, Lingareddypalli, Bathalapalli mandal**

Cattle seemed to relish fodder from ICGV 91114 more than the local cultivar JL 24. Milk yield also increased when cattle were fed fodder from this variety. Pod yields were also greater than with JL 24.

### **3. G Pulla Reddy, Talupuru, Atmakur mandal**

ICGV 91114 is an early maturing variety and the crop emerged with minimal LLS. The cattle also seem to relish the fodder, and milk yield has increased.

### **4. V Ramalinga Reddy, Gummallakunta, Bathalapalli mandal**

ICGV 91114 is a high yielder with a good shelling percentage. The kernels are bold as with JL 24. Farmers have managed to get premium prices for this variety when it was sold as seed.

### **5. P Indiramma, Jalalapuram, Bathalapalli mandal**

The variety ICGV 91114 yielded good quality haulms and also enhanced the milk productivity of milch animals. After practicing IDM, disease incidence also was substantially low compared to the local variety.

# On-farm Integrated Disease Management in groundnut and upscaling of dual purpose, short duration groundnut genotype ICGV 91114

---

KA Karim<sup>1</sup> and B Raghu Rami Reddy<sup>1</sup>

The groundnut variety most used in Anantapur district is TMV 2, which was released in 1942. Area under this variety is around 80%. Also popular is cultivar JL 24 which is widespread in the Kadiri area. Although many varieties have been introduced as an alternative to TMV 2, replacement has not taken place in spite of partial success.

Generally, farmers tend to like a variety if it stands up to prolonged drought and has the capacity to rejuvenate when the rains do come, withstands foliar disease and gives high haulm and pod yields.

Cultivar ICGV 91114, which was introduced by Suresh Pande and his team of scientists from ICRISAT during 1995/1996, has traits similar to TMV 2 and JL 24. It also yields bold pods and bold uniform kernels, which are not found in TMV 2. The oil content is higher than TMV 2 and JL 24. Its fodder has good nutritive value for dairy animals.

During 1997-1998, when ICRISAT on-farm research was devolved, Rural Development Trust (RDT) further evaluated IDM technology using ICGV 91114 in five villages in Atmakuru and Kalyandurga mandals. Although the performance of this cultivar was superior to the local TMV 2, seed of this cultivar could not be saved due to drought.

Later during the kharif season of 2002, ICRISAT again collaborated with Accion Fraternal (AF/RDT) and conducted on-farm PVS trials in Danduvaripalli and Rekulakunta villages with small quantities of cultivars ICGV 91114, ICGV 92020, 89104, 94080, 92093, 92267, 86590 and K 134, TMV 2 (local cultivar) as checks. Sowings were taken up during the first week of August 2002. There was a dry spell of 45 days after sowing.

Because of drought, pod yields were low in both villages in all the cultivars. However, ICGV 91114 yielded 0.66 t/ha and ICGV 89104 yielded 0.55 t/ha. Both these cultivars were found acceptable by most farmers as they were early-maturing and high-yielding compared to local cultivars.

---

<sup>1</sup> RDT, Anantapur, Andhra Pradesh, India.

The following year, ie, in the 2003 kharif season, AF/RDT took up ICGV 91114 and 89104 each in five holdings (half an acre each) in West Narsapuram village, Singanamala mandal. Farmers here were impressed with the performance of ICGV 91114 when it came to pod yield, fodder and tolerance to drought of 42 days when compared to ICGV 89104 and the local variety.

Having observed the performance of ICGV 91114, farmer Shyamala of West Narsapuram cultivated 1½ acres under irrigated conditions during rabi 2003-2004 and produced 30 bags of 40 kg each and sold some of it to farmers in her village as seed. This was also the beginning of participatory seed production at the village level.

During kharif 2004, ICRISAT supplied 83 bags of 30 kg each of ICGV 91114 variety for distribution and multiplication to RDT, which then distributed these among 75 farmers in six villages @ Rs 10 per kg with the understanding that they must return the same quantity of seed at the same price at the time of harvest.

### **Farmers who received seed**

- Twenty six farmers received 30 kg each; apart from these, 17 farmers purchased seed from Shyamala.
- Twenty five farmers of Sivapuram of Kanaganipalli mandal received 30 kg each.
- Seven farmers of Battuvaniapalli of Kalyandurga mandal received 60 kg each.
- One farmer of Mallapuram in Kalyandurga mandal received 60 kg.
- Ten farmers of Veligonda village of Vajrarakur mandal received 30 kg. A total of 86 farmers took up cultivation of ICGV 91114 during kharif 2004.

Although the mean annual rainfall in the area is less than the average, fortunately the 2004 kharif season had a favorable distribution of rainfall, which was good for groundnut except for one drought spell during August.

The performance of ICGV 91114 was good in all six villages and all farmers were convinced that this variety was superior to TMV 2 and was suitable to local climatic conditions. Anand Kumar of Bhattuvanipalli said that ICGV 91114 was found to be the best yielder of pods and haulms among TMV 2, JL 24 and TAG 24. In all villages, the yield increase of ICGV 91114 over local varieties ranged from 80 to 200 kg/acre (its value being Rs 1400/- to Rs 3500/acre).

From the kharif 2004 produce, RDT arranged to distribute seed of this variety to farmers of other villages for cultivating under irrigation @ Rs 10/kg on a no-loss-no-profit basis. About 59 farmers were supplied a total quantity of 1980 kg (66 bags of 30 kgs each) for kharif sowing for further multiplication under the participatory seed village concept (Table 1).

**Table 1. Details of ICGV 91114 sown under irrigated conditions during rabi, 2004-2005.**

Village	Mandal	Quantity of seed disbursed (kg)	Area sown (ac)	No. of farmers
Kundurpi	Kundurpi	60	0.60	2
Nizavalli	Kundurpi	60	0.60	2
Bandameedapalli	Kundurpi	150	1.60	5
Yerraborepalli	Settur	150	1.60	5
Mallapuram	Kalyandurga	380	42.00	3
Battuvanipalli	Kalyandurga	360	4.00	5
Sivapuram	Kanaganipalli	7000	71.75	26
Vepakunta	Kanaganipalli	240	2.60	6
Chelopalli	Ramagiri	210	2.30	7
Narsimpalli	Bathalapalli	300	3.30	8
Tumpera	Narpala	270	3.00	4
West Narsapuram	Singanamala	6600	73.00	26
Koppalakonda	Garladinne	90	1.10	3
Ragulapadu	Vajrakarur	300	3.30	3
Total		16170	172.95	105

Due to the lack of irrigation, many farmers of West Narsapuram supplied 152 bags of 40 kg each to relatives in neighboring villages with an understanding that all produce was to be sold back to the farmers in West Narsapuram after harvest. This variety has now been introduced in 105 holdings in 25 villages in Anantapur district for cultivation during rabi 2004-05.

The farmers of Sivapuram and West Narsapuram have expressed their intention to completely replace the local variety with ICGV 91114 for two seasons. RDT also plans to take up two more villages under the seed village program with ICGV 91114 during 2005/06 season.

# On-farm Integrated Disease Management for groundnut in Kadiri: Constraints and opportunities

---

Y Ramesh<sup>1</sup>

The Mysore Relief and Development Agency (MYRADA) is a voluntary organization. For 25 years, we have been working with farmers and women's self help groups (SHGs) in the Kadiri area to improve farmer incomes. We have collaborated with research institutions such as ICRISAT, ANGRAU and ARS to work on groundnut. In our work with watershed development, we are trying to improve groundwater levels for groundnut to withstand drought conditions, enabling the farmer to gain at least 2 or 3 bags per acre.

Compared to Anantapur, the area of Kadiri is rocky with rolling topography with erosive top soils of not very great depth. In 2000, ICRISAT introduced dual purpose cultivars ICGV 89104, 91114 and IDM technology suited to climate in the tract. Earlier, when farmers noticed defoliation at 60-90 days, it was assumed that the crop had matured and the crop was pulled out prematurely and haulm yield was very poor as well. Thanks to training by ICRISAT, it is now known that the leaf drop was due to foliar diseases and farmers are capable of diagnosing and spraying the crop. With IDM, farmers can gain about 2 bags per acre with good quality of fodder; gains can go upto Rs 1500/-.

In Kadiri, we met all the farmers in the area, and listed out their problems in a participatory interactive session and drew up a budget. Ten varieties of groundnut were obtained from ICRISAT and ARS, Kadiri, and evaluated in farmers' fields by following IDM technology. Farmers collectively discussed the merits of each variety and its suitability for our area in all respects. It was decided that ICGV 91114, TAG 24 and K 4 were suitable in that order of priority. We set up a village seed bank, multiplied the seed and distributed them to all farmers. Seed was multiplied in two or three villages in Nallacheruvu mandal, Anantapur. Women farmers were trained to diagnose diseases.

Soil depth in Anantapur is comparatively less - about 12 to 18 cm. We found that if red gram were sown along with groundnut as an intercrop, it takes moisture from deeper profiles and supplies additional income. Our farmers also experimented to find alternative biopesticides. The leaves of eucalyptus, neem and tobacco were boiled together and kept overnight. The liquid was sprayed the next morning and it was found to work as a fungicide in controlling leaf spot disease.

---

<sup>1</sup> Project Officer, MYRADA, Kadiri, Anantapur, Andhra Pradesh, India.

Other such experiments are still being carried out so that farmer can reduce cultivation costs. We have arranged exposure visits to ICRISAT and ARS, so that farmers may benefit even more. We have tried to support farmers through the entire process - from seed to yield. Among other measures, we encourage farmers to use organic manures and tank silt; this not only gives 25% more yield in pods and haulms but also maintains long-term carrying capacity of the soil. Farmers have also been told about the importance of optimum plant population; about 33 plants in one square meter gives an excellent crop stand and greater yield.

# Farmers' participatory crop and disease management in the Deccan Plateau: NATP experiences

---

Suseelendra Desai<sup>1</sup>

## Introduction

Known as the poor man's almond, groundnut contributes about 38% to the oilseed pool of India. About 81% of the Indian groundnut crop is rainfed where productivity hovers around 500 and 1500 kg/ha with a national average of 1000 kg/ha. Andhra Pradesh, Gujarat, Karnataka, Maharashtra and Tamil Nadu account for about 89% of the total groundnut area and constitute nearly 88% of the total groundnut production of our country. The rest are scattered in the states of Orissa, Rajasthan, Punjab, Uttar Pradesh, and Madhya Pradesh.

With an increasing limitation on resources, there is hardly any scope for horizontal growth in production and so vertical growth by increasing crop productivity and intensity is the only alternative. To do this, biotic and abiotic constraints need to be tackled in a cost effective manner.

The major foliar diseases of groundnut are early leaf spot, late leaf spot and rust. Collar rot or crown rot, stem and pod rots and dry root rot are the major diseases caused by soil-borne pathogens. Limb rot and botrytis blight are problems in some pockets. Bacterial blight fortunately is not a problem in India whereas it is one of the major constraints in South and southeast Asia. There are many minor diseases caused by fungi and actinomycetes. Among virus diseases, bud necrosis is a major constraint. Since 2000, stem necrosis disease has been a concern in Andhra Pradesh and adjoining districts of Karnataka. Aflatoxin contamination is a major pre- and postharvest problem affecting produce and trade.

Participatory research has emerged as a powerful tool to identify agro-ecosystem indicators in developing countries. Indigenous knowledge has generated complementary scientific information to the benefit of all stakeholders (Goma et al. 2001). Under the National Agricultural Technology Project (NATP), a few programs were developed to facilitate technology transfer in a participatory mode. One of the prime objectives apart from technology transfer was refinement through on-farm trials. Various governmental and non-governmental agencies were involved in these programs. Howell (1998) suggested that the participation process was greatly facilitated by the previously

---

<sup>1</sup> Senior Scientist (Pathology), CRIDA, Hyderabad 500 059, Andhra Pradesh, India.

existing relationship between the international NGOs and the communities, and also by the high level of staff input into the project. Major diseases of groundnut in the project area and experiences gathered while implementing the programs are presented in this paper.

## **Diagnostic key for major diseases**

### **Early leaf spot (*Cercospora arachidicola*)**

Symptoms of early leaf spot first appear as pale areas on the upper surface of lower leaves about 10 to 28 days after emergence. The spots later turn yellow, necrose the center of the lesion, and later the entire spot becomes necrotic. The large, circular to irregular spots measure to 1 to 10 mm in diameter and spots are characterized by a yellow halo of variable width. At maturity, the spots turn reddish brown to black. The lower surface of the spot is orange in color.

### **Late leaf spot (*Phaeoisariopsis personata*)**

Dark brown to black, circular to sub-circular lesions measuring 1 - 6 mm diameter appear on the lower surface of the quadrifoliate leaves where most sporulation occurs. Lesions are black and fruiting structures occur in concentric rings on lower surface leaflet giving lesions a slightly rough appearance on the other parts. In severe cases, oblong brown to dark brown lesions develop on the stem and branches. The late leaf spot tends to remain distinctly round, 1.5 to 5 mm in diameter and yellow halos around the spot are found only with mature spots. Spots are almost black on both the surfaces, but lower surface of the spot is distinctly black in color.

### **Rust (*Puccinia arachidis*)**

Orange red to chestnut brown elliptical raised pustules appears on the abaxial surface of the leaves. The pustules are 0.3 to 2.0 mm in diameter. The corresponding adaxial surface area of the leaf gives a grey appearance due to formation of fleck. The rust pustules are either isolated or in groups. When the pustules burst, a reddish brown mass of spores becomes visible on the surface of leaves. As the infection advances, the pustules turn dark brown and frequently coalesce to cover large areas. Normally rust infected leaves do not get detached. However, often rust and leaf spots appear together and defoliation due to leaf spots is very common. The seeds of infected plants remain small.

## **Stem and pod roots (*Sclerotium rolfsii*)**

*S. rolfsii* is a facultative parasite and is found in a wide range of soils. The fungus survives in soil mainly as sclerotia, which represent the main source of inoculum and remain viable for several months. *S. rolfsii* attacks all parts of the plant but stem infection is the most common and serious. The first symptom is sudden wilting of a branch, which is completely or partially in contact with the soil. The junction of the branch with the stem near the soil level is the most favored point of attack and a white coating of mycelium appears at infection site. Sclerotia of mustard seed size appear on the infected areas at later stages. Under congenial conditions, the pods also get infected showing sclerosis of the pod surface. Seeds when infected show pale discoloration.

## **Crown rot (*Aspergillus niger*)**

The disease appears both as pre-emergence and post-emergence rot. In the pre-emergence phase, the seed may rot and become covered with sooty black masses of spores. On germination, the hypocotyl is rapidly killed by the lesions at the collar region, resulting in rotting of the seedling before their emergence from the soil. In the post-emergence phase, initially a circular light brown lesion appears on the cotyledons and as the time advances the hypocotyl tissue or stem region becomes water-soaked and shows light brown coloration.

## **Bud necrosis (Peanut bud necrosis virus, PBNV)**

This is a virus disease and produces a variety of symptoms in groundnut. Initial symptoms appear on young quadrifoliates as mild chlorotic mottle or spots, which develop into necrotic and chlorotic rings. Necrosis of the terminal bud is a characteristic symptom, which brings the disease the name 'bud necrosis'. The secondary symptoms are stunting, auxiliary shoot proliferation and malformation of leaflets. If plants are infected early, they are stunted and bushy. Late infected plants may produce seed of normal size, but testa on such seeds are often mottled and cracked.

## **Peanut stem necrosis (Tobacco streak virus, TSV)**

Necrotic lesions and veinal necrosis symptoms first appear on young quadrifoliates. Necrosis later spreads to petiole and stem, finally killing the bud. If infection occurs at early stages, plants are killed. In some cultivars, axillary proliferation of the shoots is noticed with small leaflets in bunches with general necrosis. Growing buds show necrosis but it may also occur due to bud necrosis or any other factor. Necrosis of pegs or necrotic lesions on pods was recorded under severely infected conditions. This symptom could also be due to infection by bud necrosis virus.

## Constraints and farmer practices

A participatory rural appraisal (PRA) was conducted during the initial stages of the project to understand production systems currently in place in project areas. The PRA also helped obtain information on auxiliary data on socioeconomic aspects of the farmers.

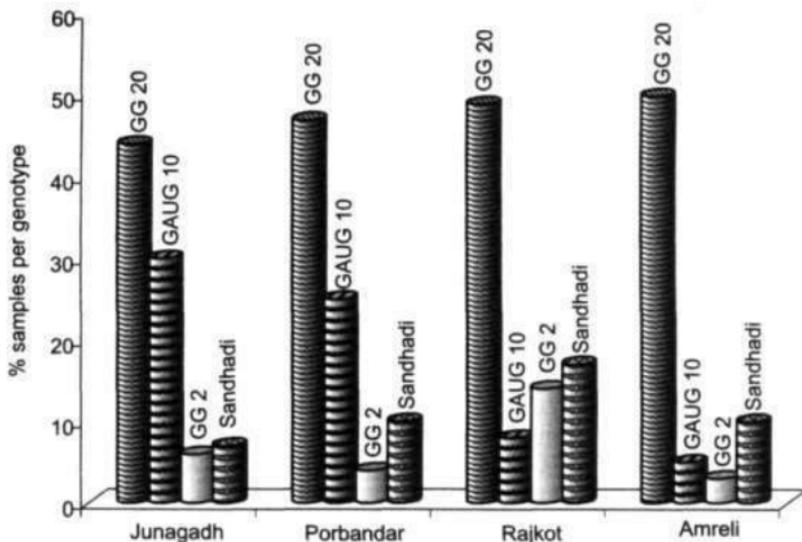
Farmers face several constraints in groundnut production. These constraints fall into various categories from seed through crop production, crop protection and marketing facilities. Through a detailed questionnaire, information was gathered on various crop production, marketing and socioeconomic constraints. A database has been prepared and the salient findings are presented here.

In Gujarat, about 205 farmers out of 1179 possessed landholdings of more than 5 ha which accounts for 17% of the farmers surveyed. About 65% of the farmers fell into the category of medium farmers and 16% belonged to the small farmers category.

Genotype plays a very significant role in achieving higher productivity. In general, across the country it was felt that there has not been a good seed replacement mechanism for penetration of improved cultivars of groundnut. Gujarat has been an exception to this rule: many improved cultivars been introduced and accepted here (Fig. 1). The genotypes included: GG 20 (548), GG 2 (120), GAUG 10 (232), Sandhadi (127), Tata sumo (51), GAUG 11 (37), Shedubhar (21), J 11 (16), Punjab 1 (6), Samudri (6), GG 13 (5), GG 5 (2), local (2), GG 12 (1) and Somnath (2). Farmers have been using six genotypes of which three were released cultivars and three farmer varieties such as Tata sumo, Sandhadi and Shedubhar. The ruling cultivar GG 20 occupied nearly 47% of the fields surveyed followed by GAUG 10 (20%). GG 20 is a Virginia bunch cultivar with good yield potential and also confectionery quality. The distribution pattern of major genotypes viz, GG 20, GAUG 10, GG 2 and Sandhadi across Gujarat was analyzed (Fig. 1).

About 70% of the farmers said they used their own seed, which signifies that they consider groundnut their main crop. Among cultivars, farmers' own seed contributed these percentages: GG 20 (32%), GAUG 10 (13%), Sandhadi (8%) and GG 2 (6%). The market as source of seed contributed about 23% of the total seed requirement. A few farmers depended on their neighbors and kits offered for trial purposes.

As against this, Andhra Pradesh and Karnataka reported a disintegrated and highly localized scenario. Most farmers used a very old variety TMV 2, demonstrating the poor rate of seed replacement in this part of the country. Although new varieties have been released for these regions also, either non-availability of seed to farmers or lack of entrepreneurship has resulted in their non-adoption. The risk taking ability and openness of Gujarat's farmers to new technologies made a big difference their achieving high productivities, an approach that was relatively lacking in Andhra Pradesh and Karnataka.



*Fig. 1. Distribution of major groundnut genotypes in target districts in Gujarat.*

In Gujarat, about 85% farmers followed monocropping of groundnut, about 12% adopted intercropping and 3% farmers followed both monocropping and intercropping depending on the area and season. In Andhra Pradesh, farmers felt sole cropping reduced levels of organic matter in soil due to the use of chemical fertilizers were unfavorable for quality produce of groundnut.

In both Gujarat and Andhra Pradesh, only about 1% of the farmers suggested that aflatoxins were economically significant in groundnut crop and 99% were not aware of aflatoxin contamination, the reason for this being that they have never seen it, except in Kutch and Bhuj districts of Gujarat. In Kutch and Bhuj, about 48% farmers knew about aflatoxins and considered it an important constraint. Interestingly, of the farmers who knew about aflatoxins, 78% hailed from Nakhatrana taluk where a training program had been organized. Aflatoxin has not widely been perceived as a major problem for various reasons: its effects on quantity or quality of produce cannot be felt or measured directly; most produce at local markets is used for oil extraction; and there is no premium for aflatoxin-free groundnuts. There is a need for raising awareness among farmers and consumers and a need for providing incentives to farmers for aflatoxin-free groundnuts.

In Andhra Pradesh, farmers felt that end-of-season soil-moisture-deficit stress was the major limiting factor in the production of groundnut in the

**Table 1. Farmers' awareness of biotic and abiotic constraints of groundnut in four districts of Andhra Pradesh.**

Constraints	Percentage of farmers aware
Leaf spots	75
Thrips	57
End-of-season soil moisture deficit stress	52
Helicoverpa	52
Bud necrosis	35
Aflatoxins	33
Stem rot	32
Collar rot	32
Jassids	23
Rust	18
Aphids	18
Termites	18
Leaf miner	16
Nematodes	<1

region. About 75% of the farmers were aware of losses due to foliar diseases and 63% were aware of root grubs as a constraint (Table 1).

Among diseases, there was more awareness of damage caused by bud necrosis followed leaf spots, stem rot and collar rot, in that order. Among insect-pests, damage due to thrips and *Helicoverpa* were considered important. However, 33% of farmers were aware of the bitter taste of kernels, which is not due to aflatoxins but the production of fatty acids.

They attributed decline in yield of groundnut to poor soil moisture retention, erratic rainfall patterns, and non-availability of high yielding varieties. The majority of farmers continue to grow groundnut as a family tradition and also due to the lack of other economically viable alternatives. Postharvest processing, such as drying and shelling are done by traditional methods, which are time-consuming and often not cost-effective. Studies conducted on the socioeconomic aspects of groundnut cultivation in Kurabalakota mandal, Chittoor district in Andhra Pradesh also revealed similar constraints (Khatana et al. 2001).

Another important constraint was the proper diagnosis of biotic stresses and their management options. In our surveys, we found that farmers are often guided by marketing agencies that offer credit facilities and that sometimes, vested interests override the interests of farmers. Private sector advisors have greater influence on individual farmers because regular contact than was customary with the public sector (Rogers 1996). Studies on sources of

information rated agricultural press, agrochemical representatives and private consultants higher than government advisory services. Biradar et al. (2003) have reported differences in farmers' perceptions in different regions with regard to quality of crop byproducts and their feeding pattern. For example, farmers of the traditional belt considered wheat straw an important fodder source, which is not utilized at all by farmers in dry areas although they grow wheat.

## **Successes and limitations of technology transfer**

Many innovative methods of technology transfer have been adopted to effectively communicate the advantages of the improved technology over conventional technology. For any technology to be effective, the basic requirement is its validation at the farmers' level and further refinement to ensure that it suits local needs.

The experiences of ICRISAT and other organizations have been quite positive. A participatory evaluation conducted in 2001 helped identify suitable cultivars (Srivastava 2002). Piraux et al. (1996) combined farmers' interests and research results to define suitable interventions for each surveyed farm, with the aim of increasing farm income and restoring soil fertility. The research also yielded elements for formulating an appropriate and realistic agricultural policy for the region. Even though there were differences among farmers of different regions, often farmers responded positively to participatory research programs. In an on-farm participatory mode, Pande et al. (2001) observed that farmers preferred new IDM-responsive genotypes viz, ICGV 89104 and ICGV 91114 over the local variety as farmers realized >50% yield benefit while the new varieties were phenotypically similar to the local variety. The acceptance of new cultivars was primarily because of high yield coupled with disease management and early maturity. These regions are drought-prone and so the crop faces quite often end-of-season drought leading immature pods and pod looses due to crust formation. As farmers also use groundnut haulm as fodder for livestock, fodder quality is also important. These genotypes maintained not only higher pod- and haulm-yields but with IDM also increased digestibility of the fodder (Pande et al. 2002). Pramanick and Mallick (1996) demonstrated through participatory testing that farmers preferred water use-efficient crops and were convinced that the technology increases productivity.

Groundnut is primarily a self-pollinated crop and as such does not offer greatly reward private companies with regard to seed production. The governmental agencies produce most of the seed and farmers also store their own seed. This practice ensures that basic seed is not replaced and old varieties continue to rule. Despite several efforts by governmental agencies to replace old varieties with new ones, the results have been unsatisfactory. In Andhra Pradesh and Tamil Nadu, the popular variety TMV 2 has been mixed over the years and it is now difficult to find pure seed of the variety.

Capacity building of farmers in cluster modes has proved to be a useful mechanism in technology transfer. A common platform for private-public partnership can improve the sustainability of production systems. Regular visits, informal discussions also help with confidence building. Horizontal spread of technology transfer must be given priority.

Various media have been used in this cause: group meetings of farmers at the research stations and villages, distribution of pamphlets in local languages, newspaper reports, radio talks, television programs and audio-visual presentations.

Peanut stem necrosis disease devastated groundnut crops in 2000 in Anantapur. In Andhra Pradesh, awareness and promotional activities to spread information about the causal organism, alternate hosts and management practices for the containment of PSND were taken on in a campaign that involved the district administration, government officials, school children and college students. Before the campaign, the Department of Agriculture officials from Anantapur, Kurnool, Mahboobnagar, Chittoor and Kadapa were made familiar with PSND and PBNB symptoms through intensive training programs. The press and electronic media played a pivotal role in spreading the message. As a result, the message reached all 1010 villages in the district.

As *Parthenium hysterophorus* is a major source of the virus inoculum, the district administration launched a mass campaign in 2001 for its removal from wastelands, vacant fields, roadsides and field bunds. However, the program lost momentum when farmers failed to get together to remove *Parthenium* from common lands and wastelands. In a similar campaign in Raichur in Karnataka, *Parthenium* was eradicated by spraying glyphosate on bunds.

## References

- Biradar N, Ramesh CR and Sukanya D H . 2003.** Fodder availability and utilization as influenced by cropping pattern - a PRA based analysis. Karnataka Journal of Agricultural Sciences 16:87-91.
- Goma H C, Rahim K, Nangendo G, Riley J and Stein A. 2001.** Participatory studies for agro-ecosystem evaluation. Agriculture, Ecosystems and Environment 87: 179-190.
- Howell P. 1998.** Crop failure in Dalocha, Ethiopia: A participatory emergency response. Disasters 22:57-65.
- Khatana VS, Lanting H and Naidu JS. 2001.** Ground realities about groundnut cultivation with special reference to the semi-arid tropics of India. *Asian Agri-History* 5(2): 123-135.
- Pande S, Bandyopadhyay R, Bluemmel M, Narayana Rao J, Thomas D and Navi SS. 2002.** Disease management factors influencing yield and quality of sorghum and groundnut crop residues. Field Crops Research 84:89-103.

**Pande S, Narayana Rao J, Upadhyaya HD and Lenne JM. 2001.** Farmers' participatory integrated management of foliar diseases of groundnut. *International Journal of Pest Management* 47:121-126.

**Piroux M, Buldgen A, Fall M and Compere R. 1996.** Participatory research and sustainable development in the Sahelo-Sudanian region. *International Journal of Sustainable Development and World Ecology* 3:39-46.

**Pramanick M and Mallick S. 1996.** Farmers' participatory approach for improvement of present status of irrigation water utilization in DVC canal command. *Water Reports*. 8:235-240.

**Rogers S. 1996.** The plant pathologist in private practice: Opportunities for the present and challenges for the future. *Plant Disease* 80:5-13.

**Srivastava SK. 2002.** On-farm and participatory evaluation of groundnut varieties for summer cultivation in Uttar Pradesh, India. *International Arachis Newsletter* 22:26-28.

# Groundnut crop management practices: Farmers' perceptions

---

**G Pulla Reddy** (Talupuru, Atmakuru Mandal, Anantapur District)

I have planted two varieties of groundnut, ICGV 91114 and ICGV 92093. I received these from ICRISAT along with local cultivars and implemented IDM technology as suggested by ICRISAT scientists. During the current season, the rains were well distributed and pod yields were good. Surprisingly, foliar diseases - which are major yield and quality reducers - were low in both ICGV 91114 and ICGV 92093 cultivars compared to our local cultivar. The quality of fodder in these two cultivars was very high ie, there was low foliar disease and the animals relished them and gave more milk than earlier.

Many farmers in my village have similar observations. I also noticed that the cultivar ICGV 92093 matured in 100 days along with ICGV 91114 instead of 130 days as in the case of TMV 2, which we normally grow. It also produced very high quality of fodder and pods.

**S Linga Reddy** (Jalalapuram, Bathalapalli Mandal, Anantapur District)

I have a lot of experience growing TMV 2. In the last three years, I have been growing JL 24 from my own seed and ICGV 91114 from ICRISAT. I have also been following the IDM package recommended by ICRISAT scientists.

With this system, we have been able to manage foliar diseases and to some extent stem and pod rots. Nothing can be done if stem necrosis disease attack the crop; preventive measures and cultural practices are the only way to manage it.

The dual purpose ICGV 91114 gave higher pod and fodder yields than JL 24. I gave some seed to other farmers and sold the rest in the market at a premium price. All farmers in the village are very happy with the variety ICGV 91114, because it gave higher pod and haulm yields than the local cultivar even under drought conditions. The fodder is also very healthy and milk yield has increased after it was fed to milch animals.

**R Suryachandra Reddy** (Talupuru, Atmakuru Mandal, Anantapur District)

I am a farmer from Talupuru village, Anantapur. I have been in agriculture for the past 30 years. Today's discussions have been very interesting and issues regarding groundnut cultivation are of interest to all farmers in this district.

Timely rains are most essential to farmers. In spite of timely rains, if the farmer is unable to adopt necessary improved practices, he could lose the crop. Today scientists have many useful tips for farmers. In truth, our ancestral fathers were very knowledgeable about cropping habits. Reluctant to listen to ancient wisdom, modern farmers have used pesticides indiscriminately and uneconomically, resulting in atmospheric pollution and health hazards to humans and cattle.

If we are to obtain higher returns we must act collectively with regard to integrated pest management etc. Awareness, capacity building and resource literacy must be improved among the farming community. Workshops of this kind are useful in imparting knowledge and provide a common platform for exchange of ideas between farmers and scientists.



## **Session III: Diseased haulm, yield, nutrition and digestibility**

---



# Effect of diseased groundnut and sorghum crop residues on nutrient utilization in cattle

Y Ramana Reddy<sup>1</sup>, K Sivaiah<sup>1</sup>, T Janardhana Reddy<sup>1</sup>, S Pande<sup>2</sup>  
and M Blummel<sup>3</sup>

## Introduction

Livestock farming is an important occupation for small and marginal farmers and landless laborers in India. To the vast arid zone and drought prone areas of the country, animal farming constitutes a type of drought proof mechanism that generates an alternate source of income. According to FAO (2002), the cattle and buffalo population of India was 219.6 and 80.6 million respectively, producing 87 million tons of milk. While milk production is increasing, feed and fodder resources are declining due to increased population, urbanization and pressure on land for cereal and cash crops. This has led to deficiency of greens, concentrates and dry fodder to an extent of 38, 44 and 45 percent (NIANP 2002) respectively and has caused livestock owners to depend more on crop residues for feeding ruminant livestock.

The major crop residues used for feeding ruminants are from cereals followed by pulses. In the Deccan Plateau in India, sorghum (*Sorghum bicolor*) straw and groundnut (*Arachis hypogaea*) haulms form a major source of dry fodder for dairy animals. In the Plateau alone, the availability of sorghum and groundnut crop residues was 14 million tons, indicating the importance of these crop residues as livestock feed. However, the quality of these crop residues is adversely affected by diseases and storage pests. These reduce nutritive value of crop residues of jowar and groundnut. During the cropping season, plant diseases such as anthracnose and leaf blight attack the sorghum crop and foliar diseases (leaf spot and rust) and stem rot affect groundnut crops, which in turn lower the quantity and quality of residues. This effects the performance of ruminants in terms of growth and milk production. In addition, fodder traders confirm that diseased crop residues command much reduced prices and eat into the profit margins compared to healthier residues (Rama Devi et al. 2000). Since no systematic studies are available on the devastating effects of plant diseases on the fodder value of crop residues, an attempt was made at Acharya

<sup>1</sup> Department of Animal Nutrition, College of Veterinary Science, ANGRAU, Hyderabad, Andhra Pradesh,

<sup>2</sup> Principal Scientist (Pathology), ICRISAT, Patancheru, Andhra Pradesh, India.

<sup>3</sup> Ruminant Nutritionist, ILRI South Asia Project, ICRISAT, Patancheru, Andhra Pradesh, India.

NG Ranga Agricultural University (ANGRAU) in collaboration with the International Livestock Research Institute (ILRI) and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) to evaluate disease-affected sorghum and groundnut crop residues in cattle and buffaloes.

### Effect on chemical composition of feed

The proximate principles (AOAC 1997) other than crude protein (CP), crude fiber (CF) and nitrogen free extract (NFE) content were not affected by the diseases (Table 1). The CP and NFE content were lower and CF was higher in diseased sorghum straw and groundnut haulms. Among cell wall constituents (Van Soest et al. 1991), the neutral detergent fiber (NDF), acid detergent fiber (ADF) and cellulose content of diseased sorghum and groundnut crop residues were higher and hemicellulose content was lower compared to healthy crop residues (Table 1). Increase in NDF, ADF and cellulose content was observed with an increase in intensity of foliar disease in sorghum straw (Gandhi et al. 1980). Decrease in CP content, soluble carbohydrates and increase in fiber fractions in diseased residues could be due to higher content of stem portion and reduced level of leaf portion. Leaf spot and rust causes general weakening of foliage by excessive spotting on the leaves, which results in defoliation. The damage caused to the leaves in addition to their loss is also responsible for low CP, soluble carbohydrate content and high fiber content.

**Table 1. Effect of disease on chemical composition (% dry matter basis) of sorghum straw and groundnut haulms.**

Nutrient	Sorghum straw		Groundnut haulms	
	Healthy	Diseased	Healthy	Diseased
<b>Proximate principle</b>				
Dry matter	90.75	87.56	91.00	89.94
Organic matter	93.78	93.93	87.90	90.75
Crude protein	05.40	03.91	10.77	08.43
Ether extract	00.90	01.00	01.40	00.62
Crude fiber	33.05	38.20	28.27	41.00
Nitrogen free extract	54.34	50.82	47.46	40.90
Total Ash	06.22	06.07	12.10	09.05
<b>Cell wall constituents</b>				
Neutral detergent fiber	66.96	69.57	70.14	71.58
Acid detergent fiber	47.59	48.86	45.50	55.54
Hemicellulose	19.37	20.71	24.64	16.04
Cellulose	35.03	38.41	33.54	43.41
Lignin	10.17	09.03	08.17	10.60

## Effect on *in vitro* and *in situ* disappearance of dry matter

*In vitro* dry matter digestibility (IVDMD) of crop residues was adversely affected by plant diseases. IVDMD was lower by 16.48 to 20.22 percent in diseased jowar (sorghum) and 16.11 to 28.85 percent in diseased groundnut haulms when evaluated (Table 2) by the Tilley and Terry method (1963) with rumen liquor of both cattle and buffaloes. Similarly the effectively degradable dry matter (EDDM) calculated by the McDonald model (1981) through *in sacco* studies (Kempton 1980) using fistulated Deoni steers and Murrah male buffaloes, was decreased by 16.91 to 22.99 percent and 16.15 to 34.87 percent respectively when diseases affected the sorghum and groundnut crops (Table 2). Lower IVDMD and EDDM of diseased crop residues may be due to high fiber and low CP content. A significant negative correlation exists between fiber content and *in sacco* DM digestibility of fodders (Rajput et al. 1991). Further, anthracnose in sorghum, leaf spot and rust in groundnut have the effect of hastening maturity which might account for higher DM disappearance of healthy sorghum and groundnut crop residues compared to diseased residues.

**Table 2. Influence of disease on *in vitro* and *in situ* dry matter degradability (%) of sorghum straw and groundnut haulms.**

Parameter	Sorghum straw				Groundnut haulms			
	Cattle		Buffaloes		Cattle		Buffaloes	
	Healthy	Diseased	Healthy	Diseased	Healthy	Diseased	Healthy	Diseased
IVDMD	37.24	29.71	37.37	31.21	48.43	40.63	58.07	43.06
Rumen kinetics								
A	14.60	14.20	19.20	12.37	27.59	20.53	47.04	16.74
B	42.28	34.60	38.69	44.72	33.57	37.52	25.38	40.39
C	0.047	0.044	0.031	0.021	0.099	0.04	0.033	0.05
EDDM	36.43	30.27	36.10	27.80	48.43	40.63	58.50	38.10

## Effect on voluntary intake and nutrient digestibility

The dry matter intake or DMI (% of body weight) was significantly ( $P < 0.01$ ) low in cattle and buffaloes fed with diseased groundnut haulms (Table 3). Feeding of diseased sorghum straw also reduced the DM intake significantly ( $P < 0.01$ ) in cattle and non-significantly ( $P > 0.05$ ) in buffaloes. Lower dry matter intake (DMI) in cattle and buffaloes fed with diseased sorghum and groundnut crop residues resulted from high fiber and low leaf content. Feeds that are of equal digestibility but differing in cell wall constituents will promote different intakes. Cell walls in leaves are easily broken down so animals given

leaves eat about 40% more DM per day than those offered stems (McDonald 1999). Further, the palatability of diseased crop residues was affected due to defoliation.

Nutrient digestibility of diseased crop residues in comparison to healthy ones is estimated by different techniques. Digestibility coefficients of DM, OM, CP and NFE was significantly ( $P < 0.01$  or  $P < 0.05$ ) higher in cattle and buffaloes, fed healthy sorghum and groundnut crop residues than those fed diseased ones (Table 3). The ether extract (EE) digestibility was significantly

**Table 3. Voluntary intake nutrient digestibility and nutritive value of diseased sorghum straw and groundnut haulms in cattle and buffaloes.**

Parameter	Sorghum straw				Groundnut haulms			
	Cattle		Buffaloes		Cattle		Buffaloes	
	Healthy	Diseased	Healthy	Diseased	Healthy	Diseased	Healthy	Diseased
DMI (kg/d)	1.95 <sup>a</sup>	1.83 <sup>b</sup>	4.32	4.09	2.71 <sup>a</sup>	2.14 <sup>b</sup>	5.61	4.21
DMI (% bwt)	1.87 <sup>a</sup>	1.68 <sup>b</sup>	1.85	1.70	2.75 <sup>a</sup>	1.87 <sup>b</sup>	2.56 <sup>a</sup>	1.73 <sup>b</sup>
Digestibility of nutrients (%)								
DM	47.54 <sup>a</sup>	43.49 <sup>b</sup>	48.32 <sup>c</sup>	44.19 <sup>d</sup>	55.56 <sup>a</sup>	48.13 <sup>b</sup>	58.57 <sup>c</sup>	50.17 <sup>d</sup>
OM	51.72 <sup>a</sup>	48.51 <sup>b</sup>	52.40 <sup>c</sup>	47.08 <sup>d</sup>	57.51 <sup>a</sup>	51.56 <sup>b</sup>	61.73 <sup>c</sup>	55.42 <sup>d</sup>
CP	50.16 <sup>c</sup>	35.27 <sup>d</sup>	42.47 <sup>c</sup>	26.35 <sup>d</sup>	60.27 <sup>c</sup>	34.64 <sup>d</sup>	47.91 <sup>c</sup>	32.29 <sup>d</sup>
EE	50.21 <sup>c</sup>	32.76 <sup>d</sup>	50.69 <sup>c</sup>	58.92 <sup>d</sup>	34.41	32.65	32.81	36.29
CF	40.94	42.25	47.16	48.65	50.46	48.23	58.83	59.21
NFE	58.46 <sup>a</sup>	54.55 <sup>b</sup>	55.74 <sup>c</sup>	48.03 <sup>d</sup>	61.76 <sup>c</sup>	58.67 <sup>d</sup>	65.55 <sup>c</sup>	53.05 <sup>d</sup>
NDF	35.09	33.57	43.94 <sup>c</sup>	38.72 <sup>d</sup>	58.83 <sup>c</sup>	47.18 <sup>d</sup>	68.97 <sup>c</sup>	53.05 <sup>d</sup>
ADF	30.32	27.26	40.83	43.56	51.21	49.06	61.36 <sup>c</sup>	44.82 <sup>d</sup>
Hemicellulose	46.55	48.13	55.67 <sup>c</sup>	27.04 <sup>d</sup>	72.90 <sup>c</sup>	40.69 <sup>d</sup>	82.68	80.41
Cellulose	33.40	36.13	38.05	40.81	56.55 <sup>c</sup>	44.73 <sup>d</sup>	56.36 <sup>c</sup>	50.84 <sup>d</sup>
Nutritive value								
Digestible crude protein (DCP) %	2.71 <sup>c</sup>	1.38 <sup>d</sup>	2.29-	1.03 <sup>d</sup>	6.49-	2.92 <sup>d</sup>	5.16 <sup>c</sup>	2.72 <sup>d</sup>
Total Digestible Nutrients (TDN) %	48.58 <sup>a</sup>	45.97 <sup>b</sup>	49.30 <sup>a</sup>	45.33 <sup>b</sup>	51.15 <sup>a</sup>	49.33 <sup>b</sup>	53.41 <sup>a</sup>	49.18 <sup>b</sup>
Metabolizable Energy (ME) (M cal/kg of DM)	1.76 <sup>a</sup>	1.66 <sup>b</sup>	1.78 <sup>a</sup>	1.64 <sup>b</sup>	1.85 <sup>a</sup>	1.78 <sup>b</sup>	1.93 <sup>a</sup>	1.78 <sup>b</sup>

ME value is calculated using the NRC (1978) formula.

<sup>a</sup> <sup>b</sup>  $P < 0.05$

<sup>c</sup> <sup>d</sup>  $P < 0.01$

( $P < 0.01$ ) lower in cattle and buffaloes fed sorghum straw but not in those fed diseased groundnut haulms. Diseases had no apparent effect on CF digestibility of crop residues. But feeding diseased groundnut haulms to cattle or buffaloes reduced the digestibility of NDF, ADF, hemicellulose and cellulose (Table 3) significantly ( $P < 0.01$  to  $P > 0.05$ ). In case of sorghum straw, diseases significantly ( $P < 0.01$ ) lowered the NDF and hemicellulose digestibility but not ADF and cellulose digestibility in buffaloes, whereas in cattle, feeding of diseased sorghum straw had no effect on fiber fractions digestibility.

Digestibility in ruminants is highly correlated positively with protein content and negatively with fiber content (Church 1980). Nutrients digestibility was low in diseased crop residues due to loss of some vital nutrients like CP and soluble carbohydrates resulting in increased amount of fiber fractions. Further increased content of phenol in diseased residues binds with protein, thereby adversely affecting its digestibility. In addition, nucleic acid content is much higher in diseased residues, which contributed to reduced CP digestibility (Tripathi and Chiranjeevi 1976). Lower digestibility of NDF, cellulose and hemicellulose fractions of diseased GN haulms could be due to its higher lignin content resulted from shedding of leaves.

## **Effect of diseases on nutritive value**

Effect of diseases of sorghum and groundnut crops on nutrient digestibility has reflected on the nutritive value of their residues expressed in terms of digestible crude protein (DCP) and total digestible nutrients (TDN) in cattle and buffaloes. DCP ( $P < .01$ ) and TDN ( $P < 0.05$ ) content of diseased sorghum straw was reduced significantly by 55.02 and 8.05 percent in buffaloes, 49.08 and 5.37 percent in cattle and that of diseased groundnut haulms by 47.29 and 7.92 percent in buffaloes and 55.01 and 3.56 percent in cattle (Table 3) compared to those fed healthy crop residues.

## **Conclusion**

From these findings, it can be concluded that diseases of sorghum and groundnut crops have devastating effect on nutrient composition, dry matter intake, *in vitro*, *in sacco* and *in vivo* digestibility of nutrients and nutritive value of sorghum straw and groundnut haulms when fed to cattle and buffaloes. Further research should be aimed at the effects of feeding diseased crop residues on growth, milk production, rumen fermentation patterns and immune response of animals in order to assess the quality of residues as livestock feed. Strategies to overcome the effects of plant diseases on crop residue quality need to be worked out.

## References

- AOAC. 1997.** Official method of Analysis. 16<sup>th</sup> Edition. Association of Official Analytical Chemist, Maryland.
- Church DC. 1980.** Digestive physiology and nutrition of ruminants. 2<sup>nd</sup> ed. Oxford Press Inc., Oregon, USA.
- FAO. 2002.** Quarterly Bulletin of Statistics. 15:12-14.
- Gandhi SK, Luthra YP, Lodhi GP and Chand JN. 1980.** Note on the influence of the date of sowing on the incidence of foliar diseases and their effect on the quality of forage sorghum. Indian Journal of Agricultural Sciences 50:363-366.
- Kempton TJ. 1980.** The use of nylon bags to characterize the potential degradabilities of feeds for ruminants. Tropical Animal Production 5:107-116.
- McDonald P, Edwards RA, Greenhalgh JFD and Morgan CA. 1999.** Animal Nutrition. Singapore: Longman Publishers.
- McDonald. 1981.** A revised model for the estimation of protein degradability in the rumen. Journal of Agricultural Science (Cambridge) 96:251-252.
- NIANP. 2002.** Annual report of National Institute of Animal Nutrition and Physiology (NIANP), Bangalore, India.
- Rajput VK, Barswal CS and Chaturvedi NC. 1991.** Evaluation of fodders *in vitro* and nylon bag techniques and their comparison with conventional values. Indian Journal of Animal Nutrition 8:83-86.
- Rama Devi K, Bandhopadhyay R, Hall AD, Indira S, Pande S and Jaiswal P. 2000.** Farmer's perceptions of the effects of plant diseases on the yield and nutritive value of crop residues used for peri-urban dairy production on the Deccan Plateau: Findings from participatory rural appraisal. Information Bulletin No. 60, ICRISAT, Patancheru, Andhra Pradesh, India.
- Tilley JMA and Terry RA. 1963.** A two-stage technique for the *in vitro* digestion of forage crops. Journal of British Grassland Society 18:104-111.
- Tripathi RK and Chiranjeevi V. 1976.** Biochemical changes in sorghum leaves infected with zonate leaf spot. Indian Journal of Mycology and Plant Pathology 6:121-123.
- Van Soest PJ, Robertson JD and Lewis BA. 1991.** Methods for dietary fiber, neutral detergent fiber non-starch polysaccharides in relation to animal nutrition. Journal of Dairy Science 74:3583 - 3597.

# Stover quality of crop residues: Groundnut and sorghum

---

M Blummel<sup>1</sup>, P Parthasarathy Rao<sup>2</sup>, S Pande<sup>3</sup>  
and BVS Reddy<sup>4</sup>

India has the largest population of ruminants in South Asia, and livestock production is an integral part of mixed farming systems. However, in recent times, specialized peri-urban/urban dairy production has been developed by the landless in many areas. The so-called "livestock revolution" will provide opportunities for increased production of milk to meet the requirements of the increasing human population and lead to improved livelihoods, provided constraints can be overcome. One of the most important technical constraints to animal production is the inadequate supply of quality feed resources throughout the year. As common property resources for grazing continue to dwindle with increased cultivation, so the dependence on crop residues (mainly cereals and legume crops) and agro-industrial by-products will increase in importance. Presently, in the semi-arid regions of India, crop residues account for 50-70% of the total dry matter fed to large ruminants. However, the fodder quality of crop residues is often low and technologies for improvement of fodder quality through chemical and biological treatment of straw were largely unsuccessful due to water, labor and capital constraints. Breeding for improved dual-purpose cultivars with superior grain and crop residue fodder quality through multidimensional crop improvement with close collaboration of plant, animal and social scientists was shown to overcome afore-mentioned constraints.

## Impact of groundnut variety ICGV 91114 on milk yields

In the Deccan Plateau in Andhra Pradesh, traditional dual-purpose groundnut crops provide most of the fodder resources fed to large ruminants. Surveys of sample farmers in project villages indicate that groundnut accounts for 61-75% of the cropped area under rainfed and irrigated conditions. Groundnut haulms provide >50% of dry fodder, and >25% of haulm is exchanged in the village. Also, the farmers purchase 75% of paddy straw from distances 100 - 150 km away, and 50% of sorghum straw from nearby villages. The traditionally

---

<sup>1</sup> Ruminant Nutritionist, ILRI South Asia Project, ICRISAT, Patancheru, Andhra Pradesh, India.

<sup>2</sup> Senior Scientist (Socioeconomics), ICRISAT, Patancheru, Andhra Pradesh, India.

<sup>3</sup> Principal Scientist (Pathology), ICRISAT, Patancheru, Andhra Pradesh, India.

<sup>4</sup> Special Project Scientist (Breeding), ICRISAT, Patancheru, Andhra Pradesh, India.

used cultivars were susceptible to a number of foliar diseases that reduced pod and haulm production and haulm (fodder) quality. Using the participatory approach and multidimensional crop improvement, cultivar ICGV 91114 was identified as highly responsive to disease management practices. It was also found to have high levels of tolerance to drought, and had superior dual-purpose characteristics. Comprehensive village level studies showed that ICGV 91114 mean pod yields and haulm yields were 15 and 17% higher respectively than those of local cultivars.

Milk yields in dairy animals (mostly buffaloes but also dairy cows) fed haulms from improved cultivar ICGV 91114 were about 10% higher (total daily yield 4.36 kg/d) than when animals were fed the local cultivars TMV 2 and JL 24 (total daily yield 3.92 kg/d). About 70-80% of milk is sold through both formal and informal channels, and income from sales ranges from 15-25% at the household level. The advantage from growing improved cultivars is therefore threefold: 1) higher pod yields, 2) higher haulm yields and 3) higher milk yields from dairy animals fed the haulms. The impact that cultivar ICGV 91114 is likely to have on the production of groundnut in Anantapur has been studied based on the performance of the cultivar in relation to the existing cultivars, ie, TMV 2 and JL 24, the two prominent varieties in the region. Adoption rates have been assumed at very conservative levels of 2, 4, and 8 percent for the period 2005-2009 for both dry and irrigated groundnut. The area under groundnut in the district is assumed to be stable at 0.8 million hectares per annum for the period of assessment. For the dairy enterprise it is assumed that 70% of the dry fodder requirement of milch animals is met by the haulm of groundnut and remaining 30% by paddy and sorghum straw. The price of pods is assumed to be Rs 16.50 per kg and milk Rs 9 per kg. Accordingly, the incremental benefit during 2005 would be around Rs 60.6 million that comprises Rs 51.4 million due to groundnut crop and Rs 9.2 million due to the dairy segment. The incremental benefit progressively increases to Rs 121.3 in 2007 and Rs 242.5 million in 2009.

## **Sorghum: Higher stover yield and quality**

The importance farmers give to stover quality was one of the major factors for the adoption of improved sorghum varieties/hybrids, since farmers felt that stover fodder quality is lower in improved cultivars when compared to traditional cultivars. With this background, improved sorghum cultivars were evaluated in comparison to traditional cultivars in farmers' fields for stover quality traits under the DFID funded project on *Exploring marketing opportunities through a research, industry and users coalition: Sorghum poultry feed* aimed at enhancing the access and availability of rainy season sorghum for poultry feed rations. The digestibility of ICRISAT/partner-released improved sorghum cultivars were

found superior. Among the cultivars analyzed, S 35 had the highest digestibility (46.3%), followed by PSV 16 (46.0%), CSV 15 (45.9%) and CSH 16 (43.0%). The digestibility of local sorghum was only 40.5%. It was also found that irrespective of the soil type, the improved cultivars are found superior to local cultivars for their stover digestibility.

Thus, the prospects for enhancing the genetic potential of sorghum cultivars for stover digestibility were evident. While the improved cultivars were on par with the local cultivars for NDM content irrespective of soil type, they were significantly superior to local cultivars for stover digestibility in *burka* and red soils. The study provides sufficient evidence to dispel farmers' perceptions about improved cultivars having poor stover nutritive value and digestibility. The improved cultivars (eg, CSV 15) are on par with the local varieties (yellow pericarp type) for fodder yield but their grain productivity is significantly higher.

# Feeding diseased vs healthy groundnut haulms: Farmers' perceptions

---

**V Ramalinga Reddy** (Gummallakunta, Bathalapalli Mandal, Anantapur District)

ICRISAT scientists (Suresh Pande and his group) gave me four varieties of groundnut seed: ICGVs 89104, 91114, 92020 and 92093 as a trial. Of these, ICGV 89104 and 91114 are early maturing, and 92020 and 92093 are medium-maturing cultivars. All these cultivars are high yielding and gave 50-60 bags/ha (40 kg/bag) of pod and very high yield of haulm, under proper management. These cultivars were also more resistant to insect pests and diseases. The fodder from these varieties was kept separate and fed to milch animals and there was a definite increase in milk yield as a result. I observed that health of buffaloes also improved.

ICGV 91114 matured in 90 days after sowing. It withstands drought better than the local variety. It can be grown under rainfed conditions as well as under irrigated conditions. ICGV 89104 has very small pods and as such is not acceptable to farmers in this area.

In my opinion, ICGV 92020 is also a good variety. Pod and fodder yields are excellent and the cultivar also withstands pests and diseases. While ICGV 91114 is suitable for rainfed as well as irrigated conditions, ICGV 92020 is suited only to irrigated conditions. Both these varieties gave higher fodder and pod yields than local cultivars.

**P Indiramma** (Jalalapuram, Bathalapalli Mandal, Anantapur District)

Fodder from ICGV 91114 was very good for milch animals. The fodder was less diseased and retained more leaves. My buffaloes started to give one extra liter of milk after being fed residue from this variety. The cultivar also yielded 1 1/2 times more pods than the local variety. I observed the crop both in kharif and rabi and the crop was excellent in both seasons. The crop matures 15 days earlier than our local variety. I sowed 45 kg seed and obtained 35 bags of 40 kg each.

# Findings from on-farm participatory rural appraisals: The ILRI experience

---

**G Venkata Rami Reddy<sup>1</sup>**

International agriculture research centers such as ICRISAT, ICARDA, CIAT, CIP, ICRAF and HTA, non government organizations (NGOs), traditional community groups have jointly initiated the multi-partner *Fodder Innovations Project* to enhance livelihoods of poor livestock keepers. They seek to do this through increasing the use of fodder through adoption of fodder innovations. The project took up fodder innovations on a pilot basis in 12 watershed villages in 2004 in partnership with Accion Fraternal/Rural Development Trust (AF/RDT), Anantapur.

AF/RDT has conducted participatory rural appraisals (PRAs) to prepare an action plan for 2004. The PRA methods used include various space related aids such as social mapping, livestock resource mapping, service and opportunities mapping; time related PRA methods such as time line, trend analysis, seasonality diagrams and matrix ranking; and scoring methods and force field analysis pertaining to issue of livestock and fodder.

The outcome of the PRA exercises clearly indicated that:

1. All livestock owners face shortage of fodder every year. They have been purchasing paddy straw, groundnut haulms or sorghum stover to supplement their crop residues.
2. Due to shortage of fodder in continuous drought-prone areas, livestock farmers have resorted to distress sales or migrating to canal command areas with their cattle.
3. Application of farmyard manure to fields has reduced considerably due to the reduction in animal population. Most farmers have shifted to using chemical fertilizers.
4. There is a great reduction of crop yields over the years due to the non-application of farm yard manure to fields. -

During PRA exercises, farmers came up with the following resolutions to overcome the fodder shortages.

- Concentrate on dual-purpose groundnut cultivar ICGV 91114 that yields more grains and provides fodder with greater nutrition.
- Take up seed multiplication of dual-purpose groundnut varieties at the village level.
- Raise fodder value crops as part of intercrops and mixed crops.

---

<sup>1</sup> Field Coordinator, Fodder Innovations Project, AF/RDT, Anantapur, Andhra Pradesh, India.

- Raise fodder value trees such as subabul and linseed in the village common property resource lands (CPR lands). Also broadcast *Stylosanthes hamata* seeds in CPR lands and protect them.
- Raise fodder value trees and broadcast *S. hamata* seeds on field bunds to meet fodder shortages.
- Take up dairy programs to support livelihoods during drought years.
- Upgrade existing milch animals for better milk yields.
- Take up green fodder crops in some part of irrigated lands.

**Session IV: Harvest management  
and marketing of pod and fodder  
(haulms) in groundnut**

---



# Management of harvesting in groundnut

---

**S Vasundhara<sup>1</sup>**

Groundnut is the major oilseed crop in Anantapur and is grown in about 8 lakh ha under rainfed conditions. The rainfall distribution and occurrence in this district is most unpredictable. Keeping this in view, farmers in this region take up sowing of groundnut immediately after the first rains from mid-June till 15 August during kharif .

Soils are shallow (15-20 cm) with relatively poor water retention, and so farmer seek to utilize available soil moisture and take up sowing quickly. Thus, there is only a short period available for groundnut sowings by using available machinery and manpower.

This competition for machinery continues for other operations like weeding and intercultivation until harvest. All these operations are time bound as timing affects yield directly.

Our observations at the Agricultural Research Station, Anantapur reveal:

- Crop growth is minimum during the moisture stress period.
- Crop recovers from moisture stress on receiving sufficient rainfall.
- Growth is faster after recovery from stress.
- Crop duration is extended if moisture stress occurs. Duration differs depending on the stage at which stress occurs.

Usually farmers harvest groundnut (when rains have been received) between 85-95 DAS because of stem rot and also assuming that no further rains will be received. This resulted in:

- Low shelling percentage.
- Not benefiting fully from late leaf spot control measures. At harvest, if the land has received light showers, farmers will prefer to harvest by hand pulling, resulting in competition for labor.

In order to avoid this and get maximum benefit from existing conditions, farmers could:

- Effectively utilize plant protection sprays by extending crop duration for a reasonable period depending on soil and crop conditions.
- Avoid competition for labor by using a cattle pair or machinery.

This would result in additional yield with increased shelling percent at no extra cost. This practice could substantially increase yields and shelling percentage in Anantapur.

---

<sup>1</sup> Senior Scientist (Plant Breeding), ARS, ANGRAU, Anantapur, Andhra Pradesh, India.

# The present marketing system for groundnut: Constraints and opportunities

---

V Reddappa Reddy<sup>1</sup>

## Introduction

Any discussion on marketing of agricultural output generally includes a few factors: marketing support from the state government and private traders, exploitation of farmers by both these agencies, failure of the state to provide opportunities for producers to fix the prices of agricultural goods themselves, and non-remunerative prices fixed by the state government.

I believe that there is scope to go beyond these and that this will, if properly exploited, help the farming community. The present paper is an attempt to discuss the 'scope' and the arguments I make and examples I take are based on discussions I had with farmers of Bathalapalli mandal who were supplied with new groundnut seed of the variety ICG V 91114.

Let me specify however that these are only stray ideas, and may not work in the field. Moreover, these ideas are presented from the perspective of farmers who attended the meeting at ICRISAT-ANGRAU, Anantapur, rather than researchers.

## Increasing the profit margin

Farmers generally take into account gross incomes from farming. It is a matter of pride for them to grow and sell as much as they can. Net returns are usually too subtle for them to grasp. Let me explain. For example, one farmer spends Rs 10000 producing groundnut. He earns a gross amount of Rs 16000 and is happy with this. He forgets that he borrowed money at an interest of Rs 2 per hundred per month and has to pay Rs 2000 towards interest. He also forgets that the bullocks he uses to raise the crop must be fed throughout the year, costing a further amount of Rs 2400 for fodder. He hardly realizes that his actual profit is only Rs 1600. How to maximize the farmer's profit must be part of any research on farming.

---

<sup>1</sup> Professor (Department of Rural Development) Sri Krishnadevaraya University, Anantapur, Andhra Pradesh, India

## **The first generation farmers**

Seed of cultivar ICGV 91114 that was used by farmers in these trials are not ordinary seed. The variety has been developed by researchers after years of effort. The seed and IDM technology was supplied to farmers free of cost. Although farmers have used these resources and reaped outputs, they have not marketed them the way it might have been expected.

To elaborate, seed of this cultivar ICGV 91114 is not available outside these sites. These farmers are first generation farmers and as such, with proper information and advertisement - dissemination about the cultivar's characteristics and yield levels - they could have commanded excellent prices for this seed. Unfortunately, farmers have ignored such a possibility, and sold them as they would any other local cultivar of groundnut.

## **Absence of grading**

Farmers are not very appreciative of grading, as it costs them more. Groundnut farmers tend to mix all varieties of groundnut, ignoring moisture levels and quality of the pods. All varieties are pooled together and sold at a cheaper rate.

Likewise, a majority of farmers mix their haulms, while they would have benefited more storing and selling them separately, specially to cattle owners from peri-urban areas, who are particular about better quality haulms.

## **Needed: A proactive approach**

One of the IDM strategies is to have all farmers in a village come together to arrange fires in the fields to attract and destroy pests. Farmers have balked at this very simple practice and it has been difficult to mobilize farmers into conducting the exercise.

Other scientists have recommended the construction of farm ponds to protect the groundnut crop during the critical dry season. Again, farmers have held back ostensibly on account of the cost, which was Rs 50000. Consequently, scientists also put forward a different model for the farm pond that cost only Rs 8000. This also, however, has received no positive response from the farmers at this conference. By implication, they are depending on the state government to help in the construction of the pond. Now my question is: 'When farmers spend several lakh of rupees digging bore wells that may or may not give them water, when they routinely collapse under the weight of heavy debts, why can they not spend a sum of Rs 8000, construct community farm ponds, and partially guarantee their crops?'

## Marketing groundnut pods and fodder: Farmers' perceptions

---

**Y Ramalinga Reddy** (Gummlakunta, Bathalapalli Mandal, Anantapur District)

We face several problems in marketing groundnut produce at local markets. If we sell the produce in our own village, the middleman takes the produce on credit and doesn't pay promptly. Businesspersons from Tamil Nadu came to our villages and purchase produce on cash payment provided we give them one kg pod extra per bag (41 kg/bag). We have preferred to do this over the years.

The popular variety TM V 2 can be sold for oil to the mills, while JL 24 can be sold as kernels also. Businessmen from Kalahasti prefer JL 24 and they buy groundnut only in the months of November and December @ Rs 800 to Rs 1000 per bag of 40 kg pods. We prefer to sell pods rather than kernels because it involves less labor. If we had a machine to dehull pods, we would have liked that because it would have meant that the husk - which is very good manure - would've remained with us. When sold as kernel, we save on transport charges, get better rates, and further benefit from the fact that shells can be recycled to the field and reduces fertilizer bills.

If the seed quality is good, it is better to decorticate and sell as seed. On the other hand, if produce is of slightly inferior variety, it is best to sell them as pods. Some discretion needs to be used when marketing groundnut.

Marketing new varieties is a problem as traders reduce the prices of pods from new cultivars. We request scientists and government agencies to look into these problems.

# **Session V: Linkages and seed systems**

---



# Sorghum for mixed crop-livestock systems in the Deccan Plateau

---

BVS Reddy<sup>1</sup>

## Introduction

Sorghum is one of the most important food and feed crops in the arid and semi-arid tropics of the world. Sorghum being C<sub>4</sub> species with higher photosynthetic capacity, and greater nitrogen and water use efficiency is relatively more drought-tolerant than other comparable cereals such as maize and comes up well in areas where it is difficult to cultivate maize. It can be cultivated in problematic soils (acidic and saline) and in a range of temperature (15 to 45°C) conditions. It fits well in a range of cropping systems with pigeonpea, cowpea, groundnut etc. In India, sorghum is the third most important food grain after rice and wheat. In the Deccan Plateau of Andhra Pradesh, postrainy season sorghum area and production (337,000 ha and 332, 000 t) are higher than figures for the rainy season (258,000 ha and 254,000 t) (CMIE 2004).

## Adaptations

Sorghum is grown in both rainy and postrainy seasons. While rainy season sorghums are grown both in vertisols and alfisols, postrainy sorghums are predominantly grown on vertisols using residual soil moisture. In regions where irrigation facilities are available either through open wells, borewells or canals, sorghums are also grown in the summer.

## Uses

While grains from rainy season-adapted sorghums are used mostly for poultry and livestock feed, alcohol and starch manufacturing (Kleih et al. 2000), stalks (stover) are used for animal fodder. Best food quality grains (lustrous, bold and semi-corneous) come from postrainy season-adapted cultivars. Stover from postrainy season sorghum is also highly valuable as animal fodder. Sorghum stover is an integral component of maintenance rations of ruminant livestock, especially of smallholder farmers. For farmers, both grain and stover (crop residue) are of equal importance in both seasons and market value of harvested stover almost equals harvested grain (Seetharam et al. 1995).

---

<sup>1</sup> Special Project Scientist (Breeding), ICRISAT, Patancheru, Andhra Pradesh, India.

## Constraints

In Andhra Pradesh, sorghum grain and stover productivity in rainy (1.0 t/ha and 2.5 t/ha) and postrainy seasons (0.9 t/ha and 2.25 t/ha) at farmers' field level is lower than productivity at research stations (6 t/ha and 12 t/ha in the rainy season and 4 t/ha and 10 t/h in the postrainy season). Among reasons are damage due to shoot fly and grain mold during the rains and shoot fly and terminal drought post rains.

## Improved cultivars

Several improved cultivars (based on ICRISAT's improved germplasm or their derivatives) for both rainy and postrainy season adaptations have been developed and released for cultivation in Andhra Pradesh and/or throughout India by ICRISAT in collaboration with Indian Council of Agricultural Research (ICAR), state agricultural universities and private seed companies.

### Rainy season

**CSV 15:** A medium duration (110 to 115 days), high yielding, dual-purpose variety released in India by the Indian Sorghum Program in 1994. CSV 15 has a tan plant color with thin and highly juicy stems with 13% sugar and a grain yield of 2.9-3.1 t/ha and a fodder yield of 12.0-13.0 t/ha.

**PSV 16 (Palem Sorghum Variety 16):** A medium duration (105 to 110 days) variety developed at Regional Agricultural Research Station, Palem, Andhra Pradesh, and released for cultivation in Andhra Pradesh. It has a tan plant color with juicy stalks (12% sugar). Grain yield of 3.0-3.5 t/ha and fodder yield of 8.0-10.0 t/ha with pearly white and medium bold grains (3.2 g/100-seeds). It is tolerant to drought and major insect pests such as shoot fly and stem borer and diseases like grain mold.

**CSH 18:** A medium duration (105 to 112 days), grain mold-tolerant hybrid developed at Jawaharlal Nehru Krishi Vishwa Vidyalaya, Indore, Madhya Pradesh, and released for cultivation throughout sorghum-growing regions in India in 2000. Plant color is tan with thick and juicy stems (16% sugar content). Grain yield of 4.8-5.5 t/ha and fodder yield of 9.0-10.0 t/ha with pearly white and medium size grains (2.8 g/100grains).

**PSH 1 (Palem Sorghum Hybrid 1):** A dual-purpose medium duration (105-110 days) hybrid, developed at Regional Agricultural Research Station (RARS), Palem, Andhra Pradesh, and released for rainy season cultivation in the state in 1998. Plant color is tan and it has thick and juicy stems. Its grain yield is 4.5-4.8 t/ha and fodder yield, 11.0-12.0 t/ha with cream-colored medium sized grains. It is tolerant to shoot fly, stem borer and rust.

**JK Jyoti:** A dual-purpose medium duration (105-110 days) hybrid developed by JK Agri-genetics, Secunderabad, Andhra Pradesh. Plant color is tan with thick and juicy stems. It produces a grain yield of 4.0-4.5 t/ha and fodder yield of 8.0-10 t/ha with cream-colored lustrous bold grains (3.6 g/100 grains). It is tolerant to drought and pests.

**MLSH296:** A dual-purpose medium duration (104-108 days) hybrid developed by Mahendra Hybrid Seeds Co Ltd, Jalna, Maharashtra. It has a tan plant color with medium thick stems. It produces a grain yield of 4.0-4.5 t/ha and fodder yield of 8.0-10 t/ha with pearly white bold grains (3.5 g/100 grains). It is tolerant to drought and aphids.

**Paras Pradhan:** A dual-purpose medium duration (105-110 days) hybrid developed by Emergent Genetics India Pvt. Ltd. It has a tan plant color with medium thick stems. It produces a grain yield of 4.5-5.0 t/ha and fodder yield of 8.0-10 t/ha with bold, white and globular grains (3.2 g/100 grains). It is tolerant to lodging.

### **Postrainy season**

**NTJ 2 (Nandyala Tella Jonna 2):** A dual-purpose late-duration (125-130 days) pure line variety developed at RARS, Nandyal, and released for postrainy season cultivation in Andhra Pradesh in 1990. It has a tan plant color with thick and juicy stems with 18.5% sugar content. It produces grain yield of 3.0-3.2 t/ha and fodder yield of 10 t/ha. Grains are pearly white and bold (3.3 g/100 grains).

**SPV 1411 (Parbhani Moti):** A dual-purpose medium duration (115-120 days) postrainy season adapted variety derived from GD 31-4-2-3, a landrace selection (IS 33844-83) developed at ICRISAT. It was developed and released by Marathwada Agricultural University, Parbhani, as 'Parbhani Moti' for postrainy season cultivation in Maharashtra in 2002. It produces a grain yield of 3.5-3.7 t/ha and a fodder yield of 7.2-7.5 t/ha. The grains (3.3 g/100 grains) are pearly white and bolder than the popular variety M 35-1 (3.1 g/100 grains). Its protein and free sugars contents and *bhakri* making and stover qualities are significantly superior to SPV 1359 and comparable to M 35-1.

**SPV 422:** A dual-purpose medium-duration (110 to 115 days) postrainy season-adapted variety derived from good grain population. It has a tan plant color with red plumes and juicy stalks. It produces a grain yield of 3.5-4.0 t/ha with good thresh ability and fodder yield of 10-11 t/ha with creamy white grains bolder than that of M 35-1.

## Irrigated areas

In the regions where irrigation facilities are available, grain sorghum hybrids are grown especially in the summer season. Hybrids such as JK Jyoti, MLSH 296, Paras Pradhan, PSH 1 and CSH 18 are suitable for cultivation at this time. Forage sorghums are popular in irrigated tracts, especially in peri-urban areas in all seasons ie, rainy, postrainy and summer seasons. Of late, sweet sorghum cultivation is also becoming popular in irrigated tracts.

### 1. Forage sorghum

The growing dairy industry has resulted in greater demand for cattle fodder. Among forage crops, sorghum offers great potential to supplement fodder resources because of its drought tolerance, wide adaptation, rapid growth, high green and dry fodder yields and good quality (Pahuja et al. 2002). The improved cultivars for the postrainy season such as NTJ 2, SPV 1411 and SPV 422, and rainy season cultivars such as CSV 15 are excellent sorghum varieties for fodder. Some other promising, high-yielding, tillering and non-tillering fodder sorghum varieties with juicy stalks are listed in Tables 1 and 2. Farmers tend to have apprehensions about stover quality of improved cultivars; however, stover quality traits such as stem sweetness, leafiness and digestibility of improved sorghum cultivars are better or at the least on par with local varieties (Table 3).

### 2. Sweet sorghum

With the Government of India's policy to blend ethanol in petrol and diesel at 5% level and the likely increase of this proportion upto 10% in a phased manner, the use of sweet stalk sorghums for ethanol production is assuming

**Table 1. Promising tillering fodder sorghum lines developed at ICRISAT, Patancheru.**

Variety	Brix's reading at maturity	Fresh fodder yield (t/ha)	Grain yield (t/ha)
IS 33558-1	21.67	54.88	0.35
HT POP-F3-47-1	17.83	50.14	3.41
ICSR 93022-1	20.00	49.84	1.52
ICSR 93019-2	16.67	48.35	3.23
ICSR 93024-1	21.67	46.66	0.37
HT POP-F3-50-1	18.50	44.76	1.73
SSG 59-3 (Check)	14.67	36.12	2.08
Mean	18.94	43.58	1.93
CV (%)	6.9	13.0	16.0
CD (5%)	2.16	9.38	0.51

**Table 2. Promising non-tillering fodder sorghum varieties developed at ICRISAT, Patancheru.**

Variety	Brix's reading at maturity	Fresh fodder yield (t/ha)	Grain yield (t/ha)
ICSR 93034	21.33	63.09	1.38
NTJ 2	22.00	55.34	0.57
E 36-1	22.00	54.20	0.84
Seredo	21.67	48.15	1.47
64 DTN	20.33	46.37	2.19
SSV 84 (Check)	22.67	54.94	0.29
Mean	17.87	36.41	3.65
CV (%)	8.39	15.52	22.96
LSD (5%)	2.43	9.18	1.36

**Table 3. Performance of improved sorghum cultivars over local varieties for grain and stover yields and for stover crude protein content and digestibility.\*\***

Genotype	Crude protein			Grain yield (t/ha)	Stover yield (t/ha)
	NDM	content*	Digestibility		
CSH 16	0.425	2.656	43.00	0.87	1.9
CSV 15	0.357	2.231	45.93	0.90	2.3
PSV 16	0.357	2.231	46.02	0.80	2.2
S 35	0.401	2.506	46.31	0.60	2.6
Local	0.385	2.406	40.46	0.30	2.5

\* Crude protein content = NDM x 6.25

\*\* The estimates are based on the laboratory analysis of stover samples of improved and local sorghum cultivars (supplied as a part of ICRISAT-led DFID-funded coalition project activity) grown by 48 farmers' in Mahbubnagar and Rangareddy districts of Andhra Pradesh.

greater importance. ICRISAT has developed several promising sweet stalk sorghum varieties (Table 4). A sweet sorghum hybrid NSSH-104 developed by National Research Centre for Sorghum from ICSA 38, an ICRISAT-bred male-sterile parent (seed) and SSV 84 (the sweet-stalk sorghum variety bred and released for general cultivation by the national program in India through extensive testing in All India Coordinated Sorghum Improvement Project in 1992/93) is being recommended for release for commercial cultivation.

**Table 4. Promising sweet sorghum varieties developed at ICRISAT, Patancheru.**

Variety	Brix's reading at maturity	Fresh cane yield (t/ha)	Juice yield (t/ha)	Grain yield (t/ha)
ICSV 574	21.67	48.98	12.13	0.69
ICSR 93034	19.33	53.68	12.06	0.31
SSV 84 (check)	22.67	59.17	13.60	0.15
Mean	15.70	43.95	12.03	4.62
SE +	0.74	3.56	1.41	0.59
CV (%)	8.1	14.0	20.4	22.0
LSD (5%)	2.05	9.90	3.94	1.63

## Conclusion

Sorghum is a versatile crop, which comes up well in a range of soil types, latitude and temperature regimes. There are different types of sorghums (grain sorghum, fodder sorghum, dual-purpose sorghum and sweet sorghum) to choose from depending on the product need and adaptations. Improved cultivars are available in all types of sorghum and farmers now have a wider choice of the cultivars than ever before. Being a drought tolerant and multi-purpose crop, sorghum is the best alternative in frequently drought-prone areas such as Anantapur. It is suitable for intercropping with other drought-tolerant crops such as pigeonpea and cowpea. As its fodder quality (green as well as stover) is excellent, it could be the best alternative to groundnut haulms. In irrigated tracts, sweet sorghum for ethanol production can be grown, if tied up with distilleries in the vicinity.

## References

- CMIE. 2004.** Economic intelligence service: Agriculture. Mumbai, India: CMIE. 364 pp.
- Pahuja SK, Grewal RPS, Naveen Singh, Padam Singh, Yogesh Jindal and Pundir SR. 2002.** Evaluation of forage sorghum hybrids for yield and morphological traits. *International Sorghum and Millets Newsletter* 43: 42-44.
- Kleih Ulrich, Bala Ravi S, Dayakar Rao B and Yoganand B. 2000.** Industrial utilization of sorghum in India. Working Paper Series No. 4. Patancheru, Andhra Pradesh, India: ICRISAT. 38 pp.
- Seetharam A, Gowda BTS, Subba Rao A and Prabhu UH. 1995.** Importance of small millets in livestock feeding and the effects of current breeding trends on nutritive value of crop residues of finger millet. Pages 54-68 *in* Crop improvement and its impact on the feeding value of straw and stover of grain cereals in India (Seetharam A, Subba Rao A and Schiere JB, eds.). Proceedings of a workshop held at Indian Council of Agricultural Research (ICAR), 21 November 1994, Krishi Bhavan, New Delhi, India.

# Seeds of choice for sustainable agriculture

---

B Sreenivas<sup>1</sup>

## Introduction

The development of seed involves several stakeholders: farmers, researchers, producers, public and private seed extension service providers. Seed is the most critical input in any production system. The term 'seed' would include traditional seeds, seedlings, cuttings, slips, grafts and tissue cultured plant; Seed can also be said to mean Sustainable Ecological and Economic Development.

Improved seed contributes to about 40% increase in crop yield while fertilizers enhance yield by 50%. Together the yield increase would be in the order of 95 percent. However, with improved crop management, there is further jump in yield to the tune of 135%. Thus, the synergy is of utmost importance. Although the agricultural community is aware of the untapped genetic potential of varietal development, they are less aware of the yet-untapped agronomic potential for improvement in crop yields. Evans of CSIRO, Australia, quotes the example of six-fold increase in potato from 1920 to the present time mainly due to improved agronomic practices without any significant increase through genetic yield potential.

## Historical perspective

In ancient agriculture, preservation of seed was mainly the farmers' responsibility. They preserved matured seeds, and sun dried them on hard threshing grounds. Alternatively, kings preserved and maintained seed banks and distributed them to farmers in times of difficulty. Seed was stored in pots, in heaps of husk and also in bowls. It was also well known that uniform seeds produce excellent results and that seed is the origin of good yields.

## Current focus

Till a new genetically engineered improvement sets in, we must take what agronomic interventions for improvement in crop production we can get while keeping seed the prime factor.

Improvement of extension knowledge, therefore, is the need of the hour. At present, public-funded agricultural extension is very limited. One conservative estimate by the National Institute of Agricultural Extension Management (MANAGE) puts the figure at 25-30 minutes/per year/per farmer

---

<sup>1</sup> Former Chief Scientist, ARS, ANGRAU, Anantapur. Presently Consultant, AMRARD, Rajendranagar, Hyderabad, Andhra Pradesh, India.

- an abysmally poor status. To bridge the gap, it is necessary to have private extension service providers, and at least one master trainee (a good practicing farmer) per habitation. In fact, the seed man's job does not end with selling of seed but starts with it. On-the-spot guidance would drastically improve yields, as examples from around the world have shown.

### **Farmer and new varieties of seeds**

Farmers are always interested in new varieties of crops that coincide with their own preferences. For example, farmers were looking to a breakthrough in groundnut that suited their ecological niche. In the absence of such a breakthrough, they used locally grown cultivar TMV 2. When ICRISAT's legumes pathology unit came out with suitable lines like ICGV 91114, varieties that were tailored to farmers' needs and overcame production constraints, they caught the sensitive eye of Anantapur's farmers. Demand for the cultivar is growing and it is certain that the district will soon be saturated with this line.

The role of the agro-based industry is also vital to the development of seed. In Saurashtra, the vegetable oil industry stores bunch varieties of groundnut for seed exchange with a runner type on barter basis as a contingent measure when the season is delayed. In another case, the gum (gaur) industry in Rajasthan helps production of improved seed of gaur on a 'no loss no profit' basis for distribution to farmers. Such options are feasible in Andhra Pradesh also; for instance with the biodiesel industry in Jatropa, Pongamia and the match industry and Poplar.

Quality of produce under the new WTO standards is important both for internal and international markets. There have been several instances where our produce has been rejected or downgraded at the international level.

- Shipment of wheat rejected by Iraq on grounds of quality.
- Turmeric affected by curcumin recovery.
- Low prices of pumpkin and banana in Japan because of lack of uniformity and desired quality.
- Cloves and cardamom inferior in quality to those available from Malaysia and other far eastern countries.

A few areas where higher demand exists and can be met with are coarse cereals as animal feed, organic food to meet the demand from 'green' consumers and the ever increasing demand of the aromatic and medicinal industry. *Sarpagandha*, *Aswagandha*, *Tulasi citronilla*, *Vertiver* and dye plants can be grown by small farmers singly or collectively. Similarly green fodder seed (Napier, Berseem, Lucerne and pasture seed like *Stylosanthes hamata*, *Cenchrus ciliaris*, etc.) can be grown to support the dairy industry.

There are innumerable options for farmers and there is a whole gamut of seed that is needed at the moment. If the inputs needed could be stepped up, all that is further needed is initiative.

# Village level seed system in groundnut: Constraints and opportunities

---

## A Satyanarayana<sup>1</sup>

Purity of seed is at the heart of agriculture. It is estimated that India's seed business amounts to Rs 50,000 crore (approx. \$11.3 billion) every year. Seed companies are growing over the years but the farmer, who buys this seed, has still not benefited substantially.

Often seed is exorbitant and the farmer has to consider carefully if he needs or indeed can afford such seed. For example, chilli seed costs Rs 50000/kg, tomato hybrid Rs 20000/kg, cotton about Rs 350 to Rs 400 per 400 g and BT cotton seed Rs 1600 per 400 g.

A liberalized agricultural environment in accordance with World Trade Organization (WTO) agreements is imminent. Apart from free import and export, seed will be patented and come at a premium and with conditions: if you buy patented seed, you must also accept all conditions dictated by that sale. Fortunately, India has maneuvered for the plant variety protection and farmers' rights. Farmers can grow their own seed, retain it for the next season and even give it away to neighbors. Once WTO becomes operational and IPR enforced, the seed can only be bought and at the rates prescribed. A kilo of BT cotton, for example, will cost Rs 1600.

What happens if we don't buy seed? If we could produce our own quality seed, there would be no need for seed companies and IPR would become moot. In order to do this, however, we to concretize our own "seed concept". In fact, this is a return to roots. This was how agriculture was traditionally conducted. Farmers would select good grains and store them safe as seed. This is no longer the case today. Seed is supplied by agricultural research stations. There is a misconception, particularly among groundnut farmers, that only seed obtained from 'outside' sources does well. In truth, any good seed must have the capacity to germinate and have vigorous growth (genetic vigor).

We must find ways to achieve quality and long shelf life of seed that we produce. Seed collection is not simply about collecting a portion of the yield; it must be done scientifically. First, it is important to choose carefully the plant from which we intend to collect seed. Let me illustrate using chilli as an example. Usually farmers select large size chillies for seed assuming that the large size indicates robustness. When the seed doesn't germinate properly, they naturally tend to blame their seed, not realizing that this is varietal deterioration. Generally, most of the crop bears medium-sized chillies. The

---

<sup>1</sup> Director of Extension, ANGRAU, Hyderabad, Andhra Pradesh, India.

right way to choose seed is to mark out plants from the center of the crop that bear greater numbers of chillies, ie, unpollinated plants. These seeds must be kept apart and they will easily crop several acres the following season. This is in no way inferior to seed bought in the market.

This could be done with other crops as well. In paddy for instance, in the case of variety BPT 5204, farmers must mark 2 to 5 cents area in the field and pluck 'off type' plants. The rest of the crop in that area can be harvested separately, dried in the shade and kept carefully as seed. Under SRI cultivation, about 10 to 12 tillers generally give 2 kgs of seed. As of now, paddy is grown in one crore acres and 30 crore kgs of seed is used to plant the crop, which means Rs 450 crore (@ Rs 15 per kg) is spent on seed alone. This huge amount could be saved and diversified if only farmers could collect and use their own seed in a scientific manner.

In Anantapur district, groundnut is cultivated in 8 lakh hectares, and 100-120 kg of groundnut kernels are used as seed per hectare, which amounts to about 20 crore kg of seed. As of now, the seed corporations supply seed on subsidy. If farmers raised their own seed, this money could be saved and used elsewhere. In Gottipadu village, Guntur district, cotton and chilly farmers used to buy hybrid seed, spending Rs 68,76,000 per year. I was aghast at the scenario and started to help them grow their own seed. Today not a single farmer from Gottipadu buys seed. At the community level, the savings are enormous.

Crops can be of two types: self and cross-pollinated. Groundnut is a self-pollinated crop. At harvest or even before that, off types or plants that are of any other or mixed variety must be removed. Plants with very good agronomic character and yield must be kept aside. It is a job that needs concentration and involvement. After sufficient seed for the next crop is chosen, the rest of the produce can be sold.

Every year, 4 to 5 lakh quintals of groundnut seed is supplied to Anantapur on subsidy. Where this seed is coming from? Traders who buy seed from farmers, sell to seed companies. The seed company then sells to the government, which in turn supplies seed to farmers. Instead farmers could well produce and preserve their seed, thereby saving money and ensuring high quality.

When the new variety 1010 in paddy was released in three mandals of West Godavari, each farmer was given 1 kg seed and asked to multiply seed. Within two years farmers there have stopped buying seed. If farmers take care to produce pure seed, quality is bound to be far superior to seed bought.

## **Hybrid seed**

Producing hybrid seed is a very simple matter. With maize as an example: sow four lines of the female parent followed by two male lines. At the time of flowering, the tassels (male flowers) come out first followed by silks (female

flowers). Before the silks emerge, the male tassels must be removed (female lines). Pollen from the male lines falls on the female lines, fertilization occurs and seed development follows. The result is a hybrid. Seed companies unnecessarily create a mystique around these types and confuse farmers.

Another advantage to farmers' producing hybrid is that male line seeds do not need to be procured time and again, as they are already available with the farmer. Hybrid seed, on the other hand, has to be replaced every year. Farmers must realize that seed from companies is also produced by farmers like themselves, and that all that such a process needs is a little training.

## The existing seed system at the village level: Farmers' perceptions

---

**P Parameswara Reddy** (Lingareddypalli, Bathalapalli Mandal, Anantapur District)

Normally, some quantity of groundnut pods collected in the kharif season is stored and used as seed in the following rainy season. At the farmer level, storage facilities are generally poor and so, most farmers sell their produce and buy seed at the time of sowing.

At harvest, some farmers keep the pods in the field for about a week for drying and then pluck them for storage. Properly dried pods are kept in gunny bags with celphos tablets to avoid inset pests. Celphos tablets are replaced periodically. Many rabi crops are grown with this seed. In fact, rabi season crops yield much fuller pods than the kharif crops. Rabi sowings are best done in November wherever there is a source of irrigation.

**K Ramachandra Reddy** (Akuledu, Singanamala Mandal, Anantapur District)

Four or five years ago, we would preserve our own groundnut seed from the rainy season for sowing the next year. However, recently 'ozzy' a storage pest has become a menace and damages stored pods. So we now depend on the state department of agriculture or the AP State Seed Corporation or Oilseed Growers Federation for groundnut seed. We would appreciate a technology to manage the pest.

# Recommendations

---



# Recommendations

---

During the course of workshop, intensive deliberations by scientists, NGO representatives and farmers resulted in the following recommendations, arrived at by consensus.

The importance of dual-purpose disease-tolerant groundnut and sorghum cultivars was well recognized. The workshop recommended further participatory research in identifying and developing new cultivars suitable to the tract.

- The workshop recommended rapid seed multiplication and distribution through peoples' institutions with interested research and NGO institutions as facilitators.
- The components of successful IDM technology for groundnut production, needs further validation and expansion in more villages.
- Convergence of line departments and development agencies must be done immediately for rapid dissemination to stakeholders.
- Further research is needed on eliminating aflatoxin contamination in grain and crop residues of dryland crops, with special emphasis on groundnut and sorghum.
- Based on consistent on-farm research data, state agricultural universities and seed companies may initiate release of promising cultivars of groundnut and sorghum.
- Measures must be taken to encourage farming systems with dual-purpose crop cultivars as the crop base with a special focus on smallholder farmers and their economic sustainability.
- The role of women in small and marginal farming systems must be studied and encouraged. Research must also seek ways to empower women and promote gender equity.
- The participants of the workshop wished to go on record by consensus that the unique project deserves special compliments and agreed on the need for its continuation so that further innovations may be achieved.



## **Invitees and participants**

---



*Inaugural session*



*Workshop participants*

# Invitees and participants

---

## **ANGRAU**

### **A Satyanarayana**

Director of Extension  
ANGRAU, Rajendranagar  
Hyderabad

### **N Krishna**

Ex-Associate Dean,  
Animal Nutrition  
ANGRAU, Rajendranagar  
Hyderabad

### **Y Ramana Reddy**

Animal Nutrition  
ANGRAU, Rajendranagar  
Hyderabad

### **K Subramanyam**

Scientist (Pathology),  
Agricultural Research Station  
Anantapur

### **NC Venkateswarlu**

Scientist (Entomology)  
Agricultural Research Station  
Anantapur

### **S Vasundhara**

Sr. Scientist (Breeding)  
Agricultural Research Station  
Anantapur

### **SK Krishna Murthy**

Sr. Scientist (Agronomy)  
Agricultural Research Station  
Anantapur

## **Padmalatha**

ARS, Reddypalli  
Anantapur

## **DAATT Centre, Anantapur**

### **P Lakshmi Reddy**

Coordinator and Sr. Scientist (Pathology)  
DAATT Centre  
Anantapur

### **K Ankayya Kumar**

Scientist (Extension)  
DAATT Centre  
Anantapur

## **SK University, Anantapur**

### **V Reddappa Reddy**

Professor  
Department of Rural Development  
SK University, Anantapur

### **G Sreedhar**

Professor  
Department of Rural Development  
SK University, Anantapur

## **NGOs and KVK**

### **YV Malla Reddy**

Executive Director  
Accion Fraterna/Rural Development Trust  
Anantapur

**Raghurami Reddy**

Technical Director  
Accion Fraterna/Rural  
Development Trust  
Anantapur

**KA Karim**

Accion Fraterna/Rural  
Development Trust  
Anantapur

**B Sreenivas**

Chief Scientist (Retd)  
Hyderabad

**GV Ramana Reddy**

Accion Fraterna/Rural Development  
Trust  
Anantapur

**Y Ramesh**

Project Officer, MYRADA  
Kadiri, Anantapur district

**S Johnson**

KVK, Reddypally,  
Anantapur

**CRIDA****Susilendra Desai**

Central Research Institute for  
Dryland Agriculture  
Santoshnagar, Hyderabad

**ICRISAT****CLL Gowda**

Global Theme Leader  
Crop Improvement

**Suresh Pande**

Principal Scientist (Pathology)

**P Parthasarathy Rao**

Sr. Scientist (Socioeconomics)

**BVS Reddy**

Principal Scientist (Breeding)

**J Narayana Rao**

Sr. Scientific Officer

**S Veera Reddy**

Scientific Officer

**V Sravan Kumar**

Scientific Officer

**D Venkateswara Rao**

Technical Officer

**Participating farmers**

38 farmers from the village  
Jalalapuram

45 farmers from the village  
Lingareddypalli

53 farmers from the village Talupuru

45 farmers from villages around  
Jalalapuram, Lingareddypalli and  
Talupuru

# విషయ సూచిక

క్ర.సం.	శీర్షిక	పుట
1.	ఇక్రిఫాట్ పక్షాన స్వాగతోపన్యాసము సి.ఎల్.ఎల్. గౌడ	131
2.	ఆచార్య ఎన్.జి.రంగా వ్యవసాయ విశ్వవిద్యాలయము పక్షాన స్వాగతోపన్యాసము ఎ. సత్యనారాయణ	132
3.	ఆర్.పి.టి. పక్షాన స్వాగతోపన్యాసము వై.వి. మల్లారెడ్డి	133
4.	ప్రాజెక్ట్ ధూమిక - ఆశయాలు ఎన్. పాండే	134
5.	ఆధిక దిగుబడులనిచ్చు వ్యవసాయ రకము బహిషిది 91114 మరియు సమగ్ర రోగ నివారణ యాజమాన్య పద్ధతులు - ఆవిర్భావము బి. శ్రీనివాస్, ఎన్. పాండే మరియు జె.నారాయణ రావు	135
6.	దక్కను వీతభూమిలోని ఆంధ్రప్రదేశ్లో పంట - పశుగణ సంబంధాలు పి. పార్థసారథి రావు మరియు వి. శ్రావణ కుమార్	136
7.	మొట్ట వ్యవసాయములో వేరుశనగ పంటకు అభివృద్ధి పరచిన మెరుగైన పద్ధతులు - అవశ్యకత టి. ఎల్లమందారెడ్డి	137
8.	వేరుశనగ పంటనాశించు శిలీంధ్ర వ్యాధులు - సమగ్ర రోగ నివారణ యాజమాన్య పద్ధతులు ఎన్.పాండే, జె. కృష్ణ కిలోర్, జె. నారాయణ రావు మరియు పి. లక్ష్మీరెడ్డి	138
9.	వేరుశనగ పంటనాశించు తెగుళ్ళు - నియంత్రణ కె. సుబ్రహ్మణ్యం	139
10.	వేరుశనగలో ఎఫ్ఐటాక్సిన్ ప్రభావము - నివారణకు యాజమాన్య పద్ధతులు ఫరీద్ నాలియార్ మరియు ఎస్. వీరారెడ్డి	140
11.	వేరుశనగ పంటలో చీడపీరులు - నియంత్రణ ఎన్.సి. వెంకటేశ్వర్లు	141
12.	దక్కను వీతభూమిలోని ఆంధ్రప్రదేశ్లో వేరుశనగకాయ మరియు మేత దిగుబడులను ప్రభావితము చేయుచున్న తెగుళ్ళు - సమగ్ర రోగ నివారణ యాజమాన్య పద్ధతులు ఎన్. పాండే, జె. నారాయణ రావు, పి. లక్ష్మీరెడ్డి మరియు జె. కృష్ణకిలోర్	142
13.	అవంతపురం జిల్లాలో వేరుశనగ పంటనాశించు తెగుళ్ళ సమగ్ర రోగ నివారణ - రైతుల భాగస్వామ్యము పి. లక్ష్మీ రెడ్డి మరియు కె. అంకయ్య కుమార్	143

క్ర.సం.	శీర్షిక	పుట
14.	స్వల్పకాలిక వేరు శనగ రకము ఐసిజివి 91114 - అనంతపురం జిల్లాలో విస్తరణ కె. ఎ. కరం, మరియు బి. రఘురామిరెడ్డి	144
15.	వేరుశనగ పంటలో యాజమాన్య పద్ధతులను పాటించుటలో అవకాశాలు - అవరోధాలు వై. రమేశ్	145
16.	దక్కను పీఠభూమిలో వేరుశనగ పంటనాశించు తెగుళ్ళు నియంత్రణలో రైతుల భాగస్వామ్యము - ఎన్ ఎ టి పి అనుభవాలు ఎస్. దేశాయ్	146
17.	వేరుశనగ పంటపై యాజమాన్య పద్ధతులు - రైతుల స్పందన	147
18.	తెగుళ్ళు సోకిన వేరుశనగ, జొన్నబొప్పలతో పశువుల మేత పోషక విలువలపై తెగుళ్ళ ప్రభావము వై. రమణారెడ్డి, కె. శివయ్య, డి. జనార్దనరెడ్డి, యస్. పాండే మరియు యమ్ బ్లామెల్	149
19.	వేరుశనగ మరియు జొన్న పంటల అవశేషాలు - మేతలో నాణ్యత యమ్. బ్లామెల్, పి. పార్థసారధిరావు, యస్. పాండే మరియు బి.వి.యస్. రెడ్డి	150
20.	తెగులు సోకిన మరియు ఆరోగ్యవంతమైన వేరుశనగ మేత - రైతుల స్పందన	151
21.	రైతుల భాగస్వామ్య పద్ధతిలో గ్రామీణ క్షేత్ర స్థాయిలో అంతర్జాతీయ పశుగణ వరిశోధనా సంస్థ (ఇఐఐ) - అనుభవాలు జి. వి.రెడ్డి	152
22.	వేరుశనగ పంట తీత పద్ధతులు - యాజమాన్యము ఎస్. వసుంధర	153
23.	ప్రస్తుత వేరుశనగ కాయ మరియు మేత అమ్మకాలలో అవకాశాలు - అవరోధాలు బి. రెడ్లప్పరెడ్డి	154
24.	వేరుశనగ కాయ మరియు మేత అమ్మకము - రైతుల స్పందన	155
25.	దక్కను పీఠభూమిలో పంట మరియు పశువుల మేత కొరకు జొన్న బి.వి.ఎస్. రెడ్డి	156
26.	సుస్థిర వ్యవసాయమునకు విత్తనములు - ఎంచీక బి. శ్రీనివాస్	157
27.	గ్రామస్థాయిలో వేరుశనగ ఉత్పత్తి అవకాశములు - అవరోధాలు ఎ. నల్లనారాయణ	158
28.	గ్రామస్థాయిలో విత్తన ఉత్పత్తి - రైతుల భావన	159
29.	సిఫారసులు	160

# ఇక్రిశాట్ పక్షాన స్వాగతోపన్యాసము

సి.ఎల్.ఎల్. గౌడ

అంతర్జాతీయ మెట్టపంటల పరిశోధనా సంస్థ (ఇక్రిశాట్) డైరెక్టర్ జనరల్ డా. విలియం డార్, డిప్యూటీ డైరెక్టర్ జనరల్ డా. డైనా కిలింగ్ గార్ల పక్షాన నేను ఈ సదస్సుకి విచ్చేసిన వారందరినీ సాదరముగా ఆహ్వానిస్తున్నాను. ఈనాటి ఈ సదస్సు ఇక్రిశాట్, అంతర్జాతీయ పశుగణ పరిశోధనా సంస్థ (ఇల్), అచార్య ఎన్.జి. రంగా వ్యవసాయ విశ్వవిద్యాలయము వారి వ్యవసాయ పరిశోధనా స్థానం, అనంతపురం, వారి సమిష్టి ఆధ్వర్యంలో జరుగుచున్నది.

1972 సంవత్సరంలో ఇక్రిశాట్ ప్రారంభమైనప్పటినుంచి అచార్య ఎన్.జి. రంగా వ్యవసాయ విశ్వవిద్యాలయముతో మాకు అనుబంధం ఉన్నది. సాంకేతిక విజ్ఞాన ప్రగతి కొరకు ఆంధ్రప్రదేశ్ రాష్ట్రములో రైతులకవసరమైన విషయాలకు సంబంధించి మా రెండు సంస్థలు కలిసి పరిశోధనలను కొనసాగిస్తూ వస్తున్నవి. సదస్సులు నిర్వహిస్తున్నవి. ఈ రోజుకొక వేరుశనగ పంటనాశించు తెగుళ్ళు - సమగ్ర యాజమాన్య పద్ధతులు' అనే విషయముపై చర్చించుకుందాము. ఈ చర్చ పంట దిగుబడి వృద్ధి చెయ్యడమే కాక, ఆరోగ్యకరమైన వేరుశనగ మేతను ఉత్పత్తి చేసి, దాన్ని పశువులకు మేపుట వలన పాల దిగుబడి కూడా అభివృద్ధి అయ్యేట్లు చెయ్యడానికి దోహదం చేస్తుంది.

ఈ పథకం మొదటి దశలో (1999-2002) రైతుల పొలాలలో వేరుశనగ, జొన్న పంటలను ఆశించు ముఖ్యమైన తెగుళ్ళు, వాటి గురించి రైతుల అభిప్రాయాలు తెలిసికొన్నాము. ఇక్రిశాట్ పరిశోధనా క్షేత్రాలలో ఈ ముఖ్యమైన తెగుళ్ళను అరికట్టుట వలన కలుగు లాభాలు, (అధిక దిగుబడులు) ఆరోగ్యవంతమైన మేతను పశువులకు మేపుట వలన వాటి జీర్ణశక్తి పెరిగినట్లు గుర్తించినాము. ఈ పథకంలోని అభివృద్ధిని ప్రోత్సహించి మద్దతు ఇచ్చిన డి.ఎఫ్.ఐ.డి., రెండవదశలో (2003-2005 సంవత్సరాలలో) వేరుశనగలో పంట, మేత రెండింటి అభివృద్ధిని సాధించేందుకు అనుమతించింది. ఈ పరిశోధనల ఫలితాలను పరిశీలించి సమీక్షించేందుకు ఈ సదస్సు ఏర్పాటు చేసినాము. జొన్న, వేరుశనగ పంటలలో వ్యాధులను నిరోధించుట ద్వారా ఎక్కువ నాణ్యత కలిగిన మేత మరియు గింజలు / కాయ ఉత్పత్తి చేయటమే మా ఆశయము. ఈ సదస్సుకి మరొకసారి మీ అందరికీ మా ఆహ్వానం.

# ఆచార్య ఎన్.జి. రంగా వ్యవసాయ విశ్వవిద్యాలయము పక్షాన స్వాగతోపన్యాసము

## ఎ. సత్యనారాయణ

ఆచార్య ఎన్.జి. రంగా విశ్వవిద్యాలయము తరపున ఈ సదస్సుకి విచ్చేసిన రైతు సోదరులకు, పాత్రికేయులకు అందరికీ ఆహ్వానము. మెట్ట వ్యవసాయములో వర్షాధారముగా పంట పండించేటప్పుడు వ్యవసాయానికి ఎంత ప్రాధాన్యత ఉంటుందో పశువులకి కూడా అంతే ప్రాధాన్యత ఉంటుంది. వర్షాకాలము అయిపోయిన దగ్గరనుండి మళ్ళీ వర్షాలు వచ్చేవరకు రైతులు పాడి పరిశ్రమగాని, గొట్టెలు, మేకల పెంపకముగాని చేపట్టినట్లయితే అధిక ఆదాయము పొందుటకు అవకాశము ఉంటుంది. పాడి-పంట అనేది నానుడి. ఈ రెండు కలిసి ఉన్నట్లయితే రైతు ఆర్థికంగా అభివృద్ధి చెందుతాడు. దీనిని దృష్టిలో పెట్టుకొనే రైతులు అనాదిగా మెట్ట ప్రాంతాలలో రెండు విధాలుగా పనికి వచ్చే పంటల్ని అంటే పశువుల మేతని, మనకు ఆహారాన్ని ఇచ్చే పంటల్ని (డ్యూయల్ క్రాప్స్) ఎక్కువగా సాగు చేస్తూ ఉండేవారు. కాని ఆధునిక వ్యవసాయము వచ్చిన తరువాత ఈ ద్వివిధ ఉపయోగ పంటల స్థానంలో వాణిజ్య పంటలు ఎక్కువగా వచ్చినవి. దానివల్ల పశువులకు మేత విపరీతంగా తగ్గిపోయినది. ఈ కారణముగా రైతు పశువులని పోషించుకోలేక పోతున్నాడు. వ్యవసాయాన్ని యాంత్రీకరణ కూడా చేయుట జరుగుచున్నది. కేవలం యాంత్రీకరణ కంటే పశువులను కూడా సమపాళ్ళలో వాడుట లాభదాయకము. ద్వివిధ ఉపయోగ పంటలు పండించినట్లయితే పశుసంపద కూడా పెరుగుతుంది. వ్యవసాయములో సుస్థిరత ఏర్పడి రోజువారీ ఆదాయమునకు అవకాశము ఉంటుంది.

అటువంటి ద్వివిధ ఉపయోగ పంటల్లో వేరుశనగ చాలా ముఖ్యమైనది. దీన్ని గురించి ఈ రోజు ఈ సదస్సులో మాట్లాడుకుంటున్నాము. రైతులు వాడే వేరుశనగ రకాలకి తెగుళ్ళు ఎక్కువగా ఆశిస్తాయి. వాటిని నిరోధించుటకు రైతులు రసాయనిక మందులు విపరీతంగా పిచికారి చేయుటవలన వాటి అవశేషాలు వేరుశనగ కట్టె (మేత) మీద ఉండి, ఆ కట్టెను పశువులకు మేవుట వలన పాల ద్వారా ఆ రసాయనాలు మనుషులకు చేరి, వారి ఆరోగ్యాన్ని నాశనం చేస్తున్నవి. కనుక వ్యాధి నిరోధక శక్తి గల వేరుశనగ రకాలను ఎంచుకుని, వాటి సమగ్ర సస్యరక్షణ యాజమాన్య పద్ధతులను ఉపయోగించి, కట్టె నాణ్యత పెంచుట చాలా అవసరము. ఈ సమగ్ర సస్య రక్షణ పద్ధతుల వలన పశువుల ఆరోగ్యమే కాకుండా, మనుషుల ఆరోగ్యము కూడా బాగుపడేటట్లు చేయుటమే ఈ పథకము యొక్క ముఖ్య అశయము. మరొక్కసారి మా తరపున మా విశ్వవిద్యాలయము తరపున అందరికీ ఆహ్వానం.

## వై.వి. మల్లారెడ్డి

ఇక్రిశాట్, ఎన్.జి.రంగా విశ్వవిద్యాలయము, కేంద్ర మెట్ట వ్యవసాయ పరిశోధనా సంస్థ (క్రీడా), శ్రీకృష్ణదేవరాయ విశ్వవిద్యాలయ శాస్త్రవేత్తలకు, రైతు సోదరులకు, మా ఆర్డిటి పక్షాన ఆహ్వానము. వేరుశనగ అతి విస్తృతముగా పండించే ఈ జిల్లాలో ఈ సమావేశము నిర్వహించుట చాలా ఉచితము. నా ఈ స్వాగతోపన్యాసములో మా సంస్థ మెట్ట వ్యవసాయము కోసము చేసే కృషిని క్లుప్తంగా వివరిస్తాను.

1. వాటర్షెడ్ అభివృద్ధి కార్యక్రమాల్లో భాగముగా మేము రైతుల భాగస్వామ్యముతో ఇప్పటివరకు ఒక లక్ష హెక్టార్ల భూమి - అనగా దాదాపు జిల్లాలో 10 శాతం భూసార సంరక్షణ కార్యక్రమమును చేపట్టినాము. ఇందుకయ్యే ఖర్చులో 10 నుండి 30 శాతం వరకు రైతులే నగదు రూపంలో ఇచ్చినారు
  2. అనంతపురం జిల్లాలో ఎక్కువగా ఉన్న కుంటలకు, చెరువులకు అవసరమైన మరమ్మతులు చేసి వాటిని పునరుద్ధరించి వర్షపు నీటి నిలుపుదల కార్యక్రమాన్ని చేపట్టినాము. ఇందులో కూడా రైతుల భాగస్వామ్యముతో పాటు, ఖర్చులో 5 నుండి 10 శాతం వరకు ఇచ్చినారు
  3. వర్షాధారము క్రింద పండ్ల తోటలు పెంచుట ప్రోత్సహించినాము. ఇవి మెట్టరైతులకు చాలా లాభదాయకము. మొదటి రెండు లేక మూడు సంవత్సరాలు మాత్రము కుండపోతతో నీటిని పోసే సదుపాయము కల్పించి మామిడి, చింత, రేగు, సపోటా వంటి పండ్ల తోటల పెంపకాన్ని అభివృద్ధి పరచినాము
  4. ఇక్రిశాట్ లాంటి వ్యవసాయ పరిశోధనా సంస్థలు అధిక దిగుబడుల కొరకు మెట్ట ప్రాంతాల రైతులకు ఇచ్చు సూచనలు విస్తృతంగా ప్రచారము చేసి, రైతులకు శిక్షణనిచ్చినాము. దీనివల్ల 10 నుండి 20 శాతం వరకు ఎక్కువ పంట వచ్చినట్లు రైతులు చెప్పినారు
  5. ఇక్రిశాట్ వారు క్షేత్రస్థాయిలో చేయు పరిశోధనలలో కూడా మేము భాగము పంచుకుంటున్నాము. అలాగే ఈ జిల్లాలో ఏ నూతన వంగడాలను వాడినట్లయితే పశువుల మేత సమస్య తీరుతుంది అనే అంశంపై జరిపే పరిశోధనలో కూడా మేము భాగస్వామ్యము వహిస్తున్నాము
- మొత్తం మీద అనంతపురం జిల్లా రైతులు కరువు పరిస్థితులను తట్టుకుంటూ ముందుకు సాగే పరిస్థితులను కల్పించటంలో మేము చేయుతనిస్తున్నాము.

## ఎస్. పాండే

తెలుగులో మాట్లాడలేని నా అశక్తతకి విచారించుచున్నాను. అయినా నా మిత్రులు నేను చెప్పే విషయాన్ని తెలుగులోకి తర్జుమా చేసి చెప్పెదరు. వేరుశనగ పండించే రైతుల ప్రయోజనము కొరకు 10 సంవత్సరాల క్రితము మేము ఈ ప్రాజెక్టుని ప్రారంభించాము. మొదట్లో ఈ పథకం వల్ల రైతులకింత ఎక్కువ ప్రయోజనము ఉంటుందని మేము గుర్తించలేదు. ఈ ప్రాజెక్టులో రెండు దశలున్నాయి. మొదటిది వేరుశనగ పంటలో తెగుళ్ళను సమర్థవంతంగా అరికట్టు పద్ధతులను అభివృద్ధి చేయుట. రెండవది ఈ పద్ధతులను రైతుల పొలాల్లో పరీక్షించి వాటి వలన కలుగు లాభాలను రైతులకు చూపించి ఆ పద్ధతులను విస్తరింప చేయుట.

పంటతో పాటు పశుగ్రాసము కూడా చాలా ముఖ్యము. ఈ రోజులలో జొన్న, వేరుశనగ గింజలు మరియు వాటి మేత దక్కను పీఠభూమిలో చాలా ప్రధానము. కాని ప్రస్తుతము రైతు ఉపయోగించే రకాల మేతలో జీర్ణశక్తితో పాటు పోషకవిలువలు కూడా తక్కువగా ఉన్నవి. మేత నాణ్యత పెంచగలిగితే పశువులకు మంచి పోషకాలు లభించి పాల దిగుబడి అధికమవుతుంది. ఈ దశలో మా పరిశోధనలలోని ప్రధానాంశము వేరుశనగ పంటకు వచ్చే వ్యాధులను అరికట్టి ఆరోగ్యవంతమైన మేతను ఉత్పత్తి చేసి పాల దిగుబడిలో సుస్థిరతను సాధించుట. ఈ రోజు ఈ సదస్సు మనము చేసిన ప్రయోగ ఫలితాలను సమీక్షించడానికి ఏర్పాటు చేయబడినది. రైతులు మూడు సంవత్సరాల నుండి వేరుశనగలో సమగ్ర రోగ నివారణ యాజమాన్య పద్ధతుల్ని పాటించుట వలన కలిగిన లాభనష్టాలను ఈ సదస్సులో చర్చించుకొందాము. మరియు మేలైన తక్కువ కాల పరిమితి గల రెండు విధాలా ఉపయోగబడే వేరుశనగ రకము, బసిజివి 91114 మరియు నాటు రకములైన జె ఎల్ 24, టి ఎం వి 2 వంటి రకాలపై రైతులు తమ అభిప్రాయాలను తెలుపకొరతాను.

**అధిక దిగుబడులనిచ్చు స్వల్పకాలిక రకము ఐ సి జి వి 91114 మరియు సమగ్ర రోగ నివారణ యాజమాన్య పద్ధతులు - ఆవిర్భావము**

**బి. శ్రీనివాస్, యస్. పొండే మరియు జి. నారాయణ రావు**

అనంతపురం జిల్లాలో దాదాపు వర్షాధారపు పంటలనే పండించెదరు. అందులో వేరుశనగ, కంది, అముదం ముఖ్యమైనవి. ఈ జిల్లాలో వేరుశనగ 8 లక్షల హెక్టార్లలో పండిస్తున్నారు. పంట విస్తీర్ణమును బట్టి చూసినట్లయితే రాష్ట్రంలో ఇది మొదటి స్థానంలో ఉన్నా ఉత్పాదకతలో హెక్టారుకి అర టన్ను మాత్రమే ఉన్నది. ఇక్కడి నేలల్లో ఎక్కువ భాగము ఎర్రనేలలు. నీటిని నిలుపుకునే శక్తి తక్కువ. భూసారము కూడా తక్కువే. ఈ జిల్లాలో అతి తక్కువ వర్షపాతము సమోదవటమే కాకుండా, అనిశ్చిత వర్షపాతము వలన పంటలు తరచు విఫలమవుతూ ఉంటాయి. ఇక్కడి పంట కాలము 90 రోజుల కంటే ఎక్కువ ఉండదని వాతావరణ శాస్త్రజ్ఞులు అంగీకరించినారు. ఇంతవరకు ఈ ప్రాంతములో విత్తు వేరుశనగ రకాల కాలపరిమితి 115-125 రోజులు. కాబట్టి పంట తరచు నష్టమవుతోంది. దీనిమీద వచ్చు ఆకుమచ్చ తెగుళ్ళు, వేరు కుళ్ళు తెగులు వంటి చీద పీడల మూలముగా పంట దిగుబడి 75 శాతం వరకు తగ్గుచున్నది. వేరుశనగ కట్టె పశువులకి ముఖ్య ఆహారము. తెగుళ్ళ మూలముగా కట్టె నాణ్యత తగ్గి పశువులకు హానికరముగా ఉంటుంది. ఇక్రిశాట్ వారు 1995లో రూపొందించిన సమగ్ర రోగ నివారణ పద్ధతిని పాటించిన రైతులు వేరుశనగలో అధిక దిగుబడులు మరియు నాణ్యమైన మేతను పొందుచున్నారు.

సమగ్ర రోగ నివారణ యాజమాన్య పద్ధతులలో ముఖ్యమైన అంశములు :

i) టిక్కా వ్యాధిని తట్టుకొను స్వల్ప కాలపరిమితి కలిగిన ఐసిజివి 91114 వంటి వంగడాలను ఎంచుకొనుట; ii) ధైరమ్ లేదా బావిస్ట్స్ అను శీలీంధ్రనాశితో విత్తనశుద్ధి చేయుట (కేజీ విత్తనాలకు 2.5 గ్రాముల శీలీంధ్రనాశిని); iii) విత్తన 60-70 రోజులకు ఒక్కసారి బావిస్ట్స్ అను శీలీంధ్ర నాశిని (1 గ్రాము ఒక లీటరు నీరు) పిచికారీ చేయుట

ఇక్రిశాట్ వారి పరిశోధనా స్థానములో సమగ్ర రోగ నివారణ పద్ధతులను ఉపయోగించి 1994-95 సంవత్సరంలో జరిపిన పరిశోధనలలో ఐసిజివి 91114 అను రకము కట్టె దిగుబడి హెక్టారుకి 2.15 టన్నులు మరియు కాయ దిగుబడి 1.5 టన్నులు ఇచ్చినది. దేశవాళీ పద్ధతిలో నాటు రకముతో సమానమైన టి.యమ్.వి.2 హెక్టారుకు 1.40 టన్నులు కట్టె (మేత), 0.90 టన్నులు కాయ దిగుబడులు వచ్చినవి. ఈ విధమైన అధిక దిగుబడులు పొందుట వలన ఇక్రిశాట్ వారు, ఎన్.జి. రంగా వ్యవసాయ విశ్వవిద్యాలయము, ఆర్.డి.టి., ఎ.ఎం.ఇ. (అంతర్జాతీయ ప్రభుత్వేతర సంస్థ) దాని అనుబంధ సంస్థల సహకారముతో 1995 నుండి 2004 వరకు సమగ్ర రోగనివారణ యాజమాన్య పద్ధతులను పరిరక్షించుటకు రైతుల భాగస్వామ్యముతో వారి పొలాలలో ప్రయోగాలు నిర్వహించినారు. ఈ ప్రయోగాలలో ఐసిజివి 91114 అను స్వల్ప కాల పరిమితి రకము రైతులకు ఆమోదయోగ్యము అని తేలినది. ఈ రకములో కాయ మరియు కట్టె కూడా నాటు రకముల కంటే సుమారు రెట్టింపు దిగుబడినిచ్చి ప్రోత్సాహకరముగా ఉన్నది. కనుక చాలా మంది రైతులు ఈ రకమును ఈ జిల్లాలోనే కాక, ఇతర జిల్లాలలో కూడా సాగు చేయుచున్నారు.

# దక్కను పీఠభూమిలోని ఆంధ్రప్రదేశ్ లో పంట పశుగణ సంబంధాలు

## వి. పార్థసారథి రావు మరియు వి. శ్రావణ కుమార్

అఖిల భారత స్థాయిలోను, ఆంధ్రప్రదేశ్ రాష్ట్ర స్థాయిలోను పంటకూ, పశువులకు చాలా దగ్గర సంబంధము ఉన్నది. పంట అవశేషాలు, అనుబంధ ఉత్పత్తులే పశువులకు ప్రధానముగా లభించు ఆహారము. పశువులు పంట సాగులో సహాయపడి విలువైన ఎరువును ఇచ్చుచున్నవి. పాడి పశువులు పాల ద్వారా అదనపు ఆదాయమును అందించును. రైతు మహిళలకిది ఎంతో సహాయముగా ఉంటుంది. పశువుల ఉత్పాదకశక్తి పాలరూపములో గాని, మాంస రూపములో గాని అవి తినే మేత మీద ఆధారపడి ఉంటుంది. ఆ మేతలో 40 నుండి 60 శాతం వరకు పంట అవశేషాలే. అనంతపురం జిల్లాలో ముఖ్యముగా జొన్నచొప్ప, శనగకట్టె ఎక్కువ. పంట ఉత్పాదకశక్తి పెరిగినట్లయితే పశుగణ ఉత్పాదకశక్తి కూడా పెరుగుతుంది. పంట ఉత్పాదకశక్తి బాగా ఉన్న ప్రదేశాల్లో వేరుశనగ మేత ఎకరానికి 2 టన్నులకు మించి ఉంటుంది. కాని అనంతపురం జిల్లాలో ఈ మేత ఎకరానికి సుమారుగా 1 టన్ను వరకు ఉంటుంది. మగ పశువులకు, ఆడపశువులకు ఉండే నిప్పత్తి అనంతపురం జిల్లాలో దాదాపు సమానము. మేకలు, గొట్టెలు తక్కువగా ఉండి పశువులెక్కువగా ఉండే చోట పశుగణ ఉత్పాదకశక్తి ఎక్కువ ఉంటుంది. అదేవిధముగా దున్నే పశువుల కంటే పాడి పశువులెక్కువగా ఉన్న చోట కూడా ఉత్పాదక శక్తి ఎక్కువ. పశువులు బీడుభూములలోని గడ్డి కంటే పంట అవశేషాల మేత పై ఆధారపడినప్పుడు వాటి ఉత్పాదకశక్తి ఎక్కువగా ఉంటుంది. ఇది పంట అవశేషాల ప్రాముఖ్యాన్ని తెలియచేస్తుంది.

ఇక్కడకు వచ్చిన రైతుల గ్రామాలను పరిశీలించినప్పుడు, ఇక్కడ పాడి పశువులు, నాగలి దున్ను పశువులు సమానంగా ఉన్నాయని, ఆవు పాల కంటే గేదె పాలు ఎక్కువగా లభ్యమవుతున్నాయని తెలిసినది. ఇక్కడి రైతులలో వారికి వచ్చే ఆదాయంలో 25 నుంచి 50 శాతం వరకు పాల అమ్మకాల నుంచి వస్తున్నది. అనంతపురం జిల్లా జలాలపురం గ్రామంలోని రైతులు ఇచ్చట పండు పంటల (ముఖ్యముగా వేరుశనగ) నుండి వచ్చు మేత సరిపోక 28 శాతం వరకు బయటనుంచి కొనుగోలు చేయుచున్నారు. ఇదే ఊరిలోని మన భాగస్వామ్య రైతులు 30 శాతం జొన్నచొప్ప, 20 శాతం వేరుశనగకట్టె కొంటున్నట్లు తెలిసినది. వ్యాధుల వలన పంట దిగుబడి కంటే మేతలో నష్టము ఎక్కువ జరుగుచున్నది. ఈ మేత మేపుట వలన పాల దిగుబడి 20 నుండి 25 శాతం తగ్గుచున్నది. వ్యాధి సోకిన మేతకు మార్కెట్ లో విలువ, పాలలో నాణ్యత తగ్గును.

# మెట్ట వ్యవసాయములో వేరుశనగ పంటకు అభివృద్ధి పరచిన

## మెరుగైన పద్ధతులు - అవశ్యకత

### డి. ఎల్లమందారెడ్డి

వేరుశనగ పంట విత్తు సమయము వర్షముపై ఆధారపడి ఉంటుంది. సాధారణముగా జూలై నెలలో వర్షము వచ్చిన వెంటనే వేరుశనగ - కంది లేక వేరుశనగ - అముదము (11:1) విత్తుదురు. వర్షం ఆలస్యం అయిన సంవత్సరములో వేరుశనగను ఆగస్టు 15 వరకు కూడా విత్తిన పరిస్థితులున్నాయి. ఆ పరిస్థితులలో వేరుశనగతో కంది వేయుట లాభదాయకము కాదు. విత్తుటకు ముందుగానే పొలమును చెక్కల గుంటకతో సేద్యము చేయుట మంచిది. ఇంతకు పూర్వము మేము లావుగా, బలముగా ఉండే గింజలనే విత్తుకోమని చెప్పాము. ఈ మధ్య వేరుశనగ పండించు విధానములో ఖర్చు తగ్గించుకొనే విషయంపై పరిశోధనలు చేశాము. వివిధ పరిమాణము కలిగిన విత్తనములను విత్తి, పరిశీలించి, సన్న విత్తనాలకు, లావు విత్తనాలకు 20 రోజుల తరువాత మొక్క పెరుగుదలలోనూ పంట దిగుబడులలోనూ ఏమీ భేదము లేదని తేలినది. మొదటి 20 రోజుల వరకు మాత్రము లావు విత్తనము ద్వారా వచ్చిన మొక్కల మొదటి ఆకులు ఘనంగా కనిపించినవి. కాబట్టి రైతులు సన్న విత్తనాలను కూడా విత్తుకోవచ్చును. దీని వలన నాలుగు ఎకరాలకు సరిపడు విత్తనము 5 ఎకరాలకు వచ్చును. అనంతపురం జిల్లాలో టి ఎం వి 2, జె ఎల్ 24, వేమన (కె 134), టి ఎ జి 24, అను వేరుశనగ రకాలు వాడుకలో ఉన్నవి. కిలో విత్తనానికి 6 మి.లీ. క్లోరోపైరిఫాస్ మరియు 2.5 గ్రా. డైతేన్ ఎమ్ 45 తో విత్తన శుద్ధి చేయుట వలన వేరు పురుగును, భూమి ద్వారా వ్యాపించు తెగుళ్ళను అరికట్టవచ్చును. మేము మెకానికల్ సీడ్ డ్రిల్ అనే సాధనము తయారు చేశాము. ట్రాక్టర్ తో విత్తనము వేయుటకు ఇది ఉపయోగపడును. ఈ మధ్యకాలములో చాలామంది రైతుల దగ్గర నాగలి, ఎద్దులు ఉండుట లేదు. నాగలి, ఎద్దుల బాడుగ చాలా ఎక్కువ. కాని రోజుకు 120 రూపాయలు బాడుగతో ఈ సాధనముతో విత్తనము సకాలంలో వేసుకోవచ్చును. ఎకరానికి 5 కిలోల విత్తనము కూడా మిగులును. నేల పరిస్థితిని బట్టి ఎరువులు వేసినట్లయితే కనీసం ఎకరానికి 300 లేక 400 రూపాయలు మిగులును. గత 20, 30 సంవత్సరాల నుంచి మన పొలాలలో డి ఎ పి వేస్తున్నాము. మన జిల్లాలో లక్ష పొలాలలోని మట్టి నమూనాలలో 80 శాతం పొలాల్లో భాస్వరం కావలసినంత ఉంది. కాబట్టి డి ఎ పి వాడకము తగ్గించవచ్చును. జింకు కొన్ని భూముల్లో తక్కువగా ఉంటుంది. ముఖ్యంగా చౌడు భూముల్లోని సైరుకు జింకు సభ్యేటు 2 గ్రా. 1 లీటర్ నీళ్ళలో కలిపి పిచికారి చేయవలెను. కంది సాళ్ళల్లో అలసందలు, ఉలవలు వేసినట్లయితే అధిక దిగుబడితో పాటు, దడి కట్టినట్టుండి నీళ్ళు నిలబడి పొలములలో ఇంకునట్లు చేయును. మట్టి కొట్టుకు పోదు. ఇసుక తోలిన భూములలో వేరుశనగ కాయ దిగుబడి ఎక్కువ ఉంటుంది. కనుక రైతులు ఈ పద్ధతులను పాటించి, అధిక ఆదాయము పొందగలరని ఆశిస్తున్నాము.

# వేరుశనగ పంట నాశించు శీలీంధ్ర వ్యాధులు- సమగ్ర రోగ నివారణ యాజమాన్య పద్ధతులు

ఎన్. పాండే, జి. కృష్ణ కిశోర్, జి. నారాయణ రావు మరియు పి. లక్ష్మీరెడ్డి

దక్కను పీఠభూమిలో వేరుశనగ పంటకు అశించు తెగుళ్లలో అకుమచ్చలు మరియు కుంకుమ తెగులు (వీటిని 'టిక్కా' తెగులు అంటారు) ఎక్కువగా పంట మరియు మేతలను నష్టపరచును. వీటితోపాటు భూమి ద్వారా వ్యాపించు కాండము మరియు కాయకుళ్ళు తెగులు, ఆన్పర్లిలన్ కాండము కుళ్ళు తెగులు, అప్లోటాక్సిన్ అను తెగుళ్ళు కూడా ముఖ్యమైనవి. ఇవి కాకుండా మువ్వ కుళ్ళు తెగులు, కాండము కుళ్ళు వైరస్ తెగులు అనే వైరస్ తెగుళ్ళకు కూడా చాలా ప్రత్యేకత ఉంది.

వేరుశనగ పంటను అశించి దిగుబడులను అధికముగా నష్టపరచు టిక్కా తెగులును సమర్థవంతముగా అరికట్టి, అధిక దిగుబడులను సాధించుటకు సమగ్ర రోగ నివారణ పద్ధతిని పాటించవలెను. ఈ పద్ధతిలో 'టిక్కా' తెగులును కొంతవరకు తట్టుకొను రకాలను ఎన్నుకొని, శీలీంధ్రనాశనితో విత్తనశుద్ధి చేసి, విత్తిన 60-70 రోజులకు శీలీంధ్ర నాశినిని పిచికారి చేయుట వలన పంటను ఈ తెగులు బారి నుండి కాపాడవచ్చును. దీనికితోడు మేలైన సేద్యపు పద్ధతులను (పంట మార్పిడి, విత్తు సమయము, మొక్కల మధ్య దూరము, అంతర పంటలు) పాటించి, అధిక దిగుబడులు పొందవచ్చును. ఒక విధమైన 'సూడోమోనాస్' అను బాక్టీరియాను "కవచ్" అను శీలీంధ్రనాశనితో తక్కువ మోతాదులో కలిపి పిచికారీ చేయుట వలన కూడా ఈ టిక్కా తెగులును కొంతవరకు తగ్గించవచ్చును.

అదేవిధముగా గోరింట లేక, ఉమ్మెత్త చెట్ల ఆకుల కషాయము తీసి, నీటిలో కలిపి వేరు శనగ పంటపై "టిక్కా" తెగులు సోకిన వెంటనే పిచికారీ చేయుట వలన కూడా ఈ తెగులు ఉద్రిక్తతను తగ్గించవచ్చును.

భూమి ద్వారా వ్యాపించు తెగుళ్ళను సహజరోగనిరోధక వంగడాలను వాడుట, శీలీంధ్ర నాశనితో విత్తనశుద్ధి చేయుట, మేలైన సేద్యపు పద్ధతులను పాటించుట వలన కొంతవరకు అరికట్టవచ్చును.

'ట్రైకో డెర్మా' అను శీలీంధ్రముతో విత్తన శుద్ధి చేయుట వలన కూడా భూమి ద్వారా వ్యాపించు తెగుళ్ళను కొంతవరకు అరికట్టవచ్చును. ఈ విధముగా సమగ్ర రోగ నివారణ పద్ధతులను పాటించినట్లయితే రైతులు వేరుశనగ పంటలో అధిక దిగుబడి, నాణ్యమైన పశువుల మేత పొందుటకు అవకాశము ఉన్నది.

## వేరుశనగ పంటనాశించు తెగుళ్ళు - నియంత్రణ

### కె. సుబ్రహ్మణ్యం

వేరుశనగ పంటకు అనేక రకముల తెగుళ్ళు వచ్చు అవకాశము ఉంది. ఈ తెగుళ్ళలో ఆకుమచ్చ తెగులు (టీక్కా తెగులు), కాండము మరియు కాయకుళ్ళు తెగులు, ఆస్పర్జిలెస్ కాండము కుళ్ళు తెగులు మరియు మువ్వ కుళ్ళు, కాండం కుళ్ళు వైరస్ తెగుళ్ళు చాలా ముఖ్యమైనవి. ఇప్పటివరకు ఆకుమచ్చ తెగుళ్ళు వాటి సమగ్ర రోగ నివారణ పద్ధతుల గురించి తెలుసికొన్నాము. ఈ మధ్యకాలములో మువ్వకుళ్ళు, కాండము కుళ్ళు వైరస్ తెగుళ్ళు వేరుశనగ పంటను అశించి ఎక్కువ నష్టపరుచుచున్నవి. కనుక ఈ తెగుళ్ళ గురించి వివరముగా చర్చించుకొందాము. మువ్వకుళ్ళు తెగులు విత్తిన నెలలో అశించినట్లయితే మొక్కలో ఎదుగుదల ఉండదు. మొక్కలు గిడసబారి గుబురుగా ఉండును. ఈ మొక్కలు కాయలు కాయవు. మువ్వ కుళ్ళు వ్యాపించిన మొక్కలు కొన్ని చని పోవును. ఈ వ్యాధి సోకిన మొక్కలు మువ్వ చనిపోయినప్పటికీ వర్షం పడినట్లయితే మువ్వ దగ్గర కొత్త ఆకులు వచ్చి అవి చిన్నవిగా, గుబురుగా పెరుగును. కాండము కుళ్ళు వైరస్ తెగులు కలుపు మొక్కల ద్వారా వేరుశనగకు వ్యాపించును. వేరుశనగ పొలములో పెరుగు కలుపు మొక్కలలో 60, 70 రకాలున్నవి. వీటిలో పుష్పించు మొక్కలన్నీ వైరస్ కి ఆశ్రయము ఇచ్చును. వయ్యారిభామ అనే కలుపు మొక్క ఎల్లప్పుడూ పూత పూస్తూనే ఉంటుంది. కనుక ఇది ఎక్కువ వైరస్ ను సరఫరా చేయును. పొలాల చుట్టూ గట్ల మీద ఈ కలుపు మొక్కలుంటాయి. కనుక పొలం అంచుల్లో ఉండే వేరుశనగ మొక్కలు ఎక్కువగా ఈ వ్యాధి సోకి చనిపోతాయి. పొలం మధ్యలోకి పోయినకొద్దీ తెగులు తీవ్రత తగ్గుతూ వస్తుంది. కాబట్టి చుట్టూ కలుపు మొక్కలు లేకుండా ముఖ్యంగా వయ్యారిభామ (ప్రార్థీనియం) లేకుండా చేయుట వలన ఈ వ్యాధి ఉధృతను తగ్గించవచ్చును. ఈ తెగులును అరికట్టే మందులు లేవు. ఈ తెగులు ఆకులలోని రసం వీల్చు తామర పురుగుల ద్వారా వ్యాప్తి చెందుతుంది. కాబట్టి రసం వీల్చు పురుగుల్ని కాన్పిడార్ తో విత్తనశుద్ధి చేసి నియంత్రించవచ్చును. మేరసాలుగ జొన్నకాని, సజ్జికాని వేసుకుంటే అది దీటిలాగ పనిచేసి, తామరపురుగుల కదలికను నిరోధించును. టీక్కా ఆకుమచ్చ తెగులుకు బావిస్టిన్ అను శీలీంధ్ర నాశినిని 1 గ్రాము 1 లీటరు నీటిలో కలిపి పిచికారీ చేయుట ద్వారా అరికట్టవచ్చును. కాండము మరియు కాయకుళ్ళు తెగులు భూమి ద్వారా వ్యాపించు శీలీంధ్రము ద్వారా వచ్చును. టీక్కా ఆకుమచ్చ తెగులును నివారించినట్లయితే కాండము మరియు కాయకుళ్ళు తెగులును కొంతవరకు నివారించవచ్చును.

# వేరుశనగలో ఎఫ్లోటాక్సిన్ ప్రభావము - నివారణకు యాజమాన్య పద్ధతులు

ఫరీద్ వాలియార్ మరియు ఎస్. వీరారెడ్డి

అస్పర్జిలస్ ఫ్లేవస్, అస్పర్జిలస్ పారసైటికస్ అను రెండు రకముల శిలీంధ్రాలు వేరుశనగ కాయ మరియు మేతలో ఎఫ్లోటాక్సిన్ అను విషపూరిత రసాయన పదార్థాలను ఉత్పత్తి చేయుచున్నవి. పంట తీతకు ముందు, తీసే సమయములో, తీసిన తరువాత ఇలా అన్ని దశల్లోనూ ఈ శిలీంధ్రాలు వేరుశనగ పంటనాశ్రయించే అవకాశము ఉంది. దీనివల్ల దిగుబడి దెబ్బ తినదుకాని, కాయ మరియు మేత నాణ్యత కోల్పోయి మానవులకు, పశువులకు ఆరోగ్యమునకు హాని చేయును. ఈ వ్యాధి సోకిన మేత తిన్న పశువుల పాలలో కూడా ఈ రసాయనాలు చేరి, ఈ పాలు త్రాగినవారికి కాన్సర్ వంటి వ్యాధులు సోకే అవకాశము ఉన్నది. హెపటైటిస్ బి, హెపటైటిస్ సి (కామెర్షు) ఉన్న వాళ్ళకి ఆ వ్యాధి ఇంకా ఉధృతమవుతుంది. ఈ శిలీంధ్రాలు సోకిన కాయలు ఎగుమతులకు అవకాశము లేదు. ఈ ఎఫ్లోటాక్సిన్ కలుగచేసే శిలీంధ్రాలు 10 నుండి 40 డిగ్రీల ఉష్ణోగ్రతలో బాగా పెరుగును. వేరుశనగ కాయలను పురుగులాశించినప్పుడు, కాయలమీద పగుళ్ళు వచ్చినప్పుడు ఈ శిలీంధ్రాలు కాయల లోపలికిపోయి రసాయనాలను ఉత్పత్తి చేయును. నేల ఉష్ణోగ్రత ఎక్కువగా ఉన్నప్పుడు, పంటతీతకు ముందు బెట్ట తగిలినప్పుడు కూడా ఈ వ్యాధి వ్యాపించును. ఏరుడు కాయలలో ఈ శిలీంధ్రాలు ఎక్కువగా చేరి పెరుగుతూ ఉండును. కనుక ఆ ఏరుడు కాయలు తెచ్చి ప్రధాన పంటలో కలిపినట్లయితే వాటికి కూడా ఈ వ్యాధి సోకును. కాయలలో తేమ ఎక్కువగా ఉన్నట్లయితే ఎఫ్లోటాక్సిన్ ఉత్పత్తి ఎక్కువగా ఉండును. కాబట్టి కాయలను బాగా ఎండపెట్టినట్లయితే ఈ వ్యాధిని కొంతవరకు నివారించవచ్చును.

ఇక్రికాల్ రూపొందించిన వ్యాధి నిరోధక రకాలను సాగు చేసినట్లయితే ఎఫ్లోటాక్సిన్ ప్రభావము తగ్గించవచ్చును. ఎఫ్లోటాక్సిన్ సోకని లేక తక్కువ మోతాదులో ఉన్న కాయలకు మంచి ధర వచ్చును. ఐసిజివి 94434, 94379, 94384 అను మూడు రకాలకు ఎఫ్లోటాక్సిన్ వ్యాధిని తట్టుకొను శక్తి ఉన్నది. విత్తన శుద్ధి చేయుట, కంపోస్టుతో కలిపి జిప్సంవాడుట, ట్రైకోడెర్మా అను జీవ పదార్థములను వాడుట వలన ఎఫ్లోటాక్సిన్ చాలా శాతం తగ్గే అవకాశము ఉన్నది. కనుక రైతులు ఈ పద్ధతులను పాటించి, వేరు శనగ పంటలో ఎఫ్లోటాక్సిన్ ప్రభావము తగ్గించి, నాణ్యమైన కాయ మరియు మేత దిగుబడులను పొందవచ్చును.

# వేరుశనగ పంటలో చీడపీడలు - నియంత్రణ

## ఎన్.సి. వెంకటేశ్వర్లు

వేరుశనగ పైరును ఆశించి పంటను నష్టపరచు పురుగులు ప్రధానముగా మూడు రకములు

1. ఆకు తినే పురుగులు 2. ఆకు రసం పీల్చు పురుగులు 3. వేరు, కాండమును ఆశించు పురుగులు

ఆకుతినే పురుగులలో ఎర్రగొంగళి పురుగు, లద్దెపురుగు, పచ్చపురుగు, ఆకుముడత పురుగు అనేవి ఎక్కువగా పంటను నష్టపరచును. రసంపీల్చు పురుగులలో పేనుబంక, పచ్చదోమ (డీపం పురుగు), తామరపురుగు, ఎర్రనల్లి ముఖ్యమైనవి. వేరుపురుగు, కాండము తొలిచే పురుగులు కూడా వేరుశనగ పంటను బాగా నష్టపరుచును. భూమిలో కోశస్థ దశలో ఉండు ఎర్రగొంగళి పురుగు నియంత్రణలో రైతులు కొన్ని మొలకువలు పొటించవలెను. వేసవిలో పొలమును దుక్కి దున్నుట మొదటి పని. పురుగు ఉధృతిని గమనించినప్పుడు ఆ గ్రామములోని రైతులంతా కలిసి, సామూహికముగా పొలము గట్లమీద మంటలు వేసినట్లయితే తల్లి పురుగు అయిన రెక్కల పురుగును అరికట్టవచ్చును. వేపగింజల నూనెను పంటపై పిచికారి చేయుట వలన గుడ్లను సశింప చేయవచ్చును. తేలికపాటి మందులు క్విన్టాల్ ఫాస్ గాని మోనోక్రోటోఫాస్ గాని పిచికారి చేసి కూడా వీటి బెడద నివారించుకోవచ్చును. లద్దెపురుగు, పచ్చపురుగు, ఆకుముడత పురుగులను సముగ్ర సస్యరక్షణ పద్ధతులను అనుసరించి నివారించవచ్చును. మోనోక్రోటోఫాస్ పిచికారి చేసి పేనుబంక, పచ్చదోమల బెడద తగ్గించవచ్చును. కలుపుమొక్కల నివారణ తామరపురుగుల బాధను తొలగించును. ఫోరేట్ గుళికలు కాని, క్లోరోఫైరిఫాస్ కాని పిచికారి చేసి వేరుపురుగు, కాండము తొలిచే పురుగులను నివారించవచ్చును. సింథటిక్ పెర్రాథ్రాయిడ్ పంటి ప్రమాదకరమైన మందులను వాడరాదు.

# దక్కన్ వీరభూమిలోని ఆంధ్రప్రదేశ్లో వేరుశనగకాయ మరియు మేత దిగుబడులను ప్రభావితము చేయుచున్న తెగుళ్ళు- సమగ్ర రోగ నివారణ యాజమాన్య పద్ధతులు

ఎన్. పాండే, జి. నారాయణ రావు, పి. లక్ష్మీరెడ్డి మరియు జి. కృష్ణ కిశోర్

వేరుశనగ పంటలో "టిక్కా" తెగులు, (ఆకుమచ్చలు మరియు తుప్పుతెగులు) చాలా ముఖ్యమైనది. కాండము మరియు కాయకుళ్ళు, ఎఫ్లోటాక్సన్ మువ్వకుళ్ళు మరియు కొడము కుళ్ళు వైరస్ తెగుళ్ళు కూడా పంటను నష్టము చేయుచున్నవి. ఈ వ్యాధుల వల్ల పంటలో దిగుబడి మరియు నాణ్యతలు తగ్గుట వలన రైతులకు ఎక్కువగా నష్టము కలుగుచున్నది. వీటిలో ముఖ్యమైన 'టిక్కా' తెగులను నివారించుటకు సమగ్ర రోగ నివారణ పద్ధతిని పాటించుట మేలైన మార్గము. ఈ పద్ధతిలోని మొదటిది వ్యాధిని తట్టుకొను ఐపిజివి 91114 లాంటి రకములను ఎన్నుకొనుట. రెండోది శిలీంధ్రనాశనితో (బావిప్టినీ + థైరమ్ 1:1) 2.5 గ్రాములు ఒక కిలో విత్తనములకు విత్తన శుద్ధి చేయుట. ఆ తరువాత విత్తన 60-70 రోజులకు బావిప్టినీ అను శిలీంధ్రనాశనిని ఒక గ్రాము ఒక లీటరు నీటిలో కలిపి పిచికారీ చేయుట. మా పరీక్షా కేంద్రాలలోను మరియు రైతుల భాగస్వామ్యములోను ఊరిపిన సమగ్ర రోగ నివారణ ప్రయోగాలలో ఐపిజివి 91114 అను రకమునకు విత్తన 60-70 రోజుల మధ్య ఒక్కసారి కవచ్ అను శిలీంధ్రనాశనితో పిచికారి చేయుట వలన రైతులు వాడు నాటు రకము కంటే టిక్కా ఆకుమచ్చ తెగులు తక్కువగా సోకి, కాయ మరియు మేత దిగుబడి అధికంగా వచ్చినది. ఈ ఐపిజివి 91114 రకములో మేత ఆరోగ్యముగా ఉండి జీర్ణశక్తి అధికముగా ఉందని ఇల్లీలోని పౌష్టికాహారనిపుణులు ప్రయోగాత్మకంగా పరిశీలించారు. మేము చాలా కొద్దిమందికిచ్చిన ఐపిజివి 92093 రకం కూడా దాదాపు ఐపిజివి 91114 వలె ఉన్నది. కాకపోతే ఈ రకానికి నీరు ఎక్కువగా కావాలి. ఈ రకమునకు రోగ నిరోధక శక్తి, అధిక దిగుబడి ఎక్కువగా ఉండుట విశేషము. భాగస్వామ్య విధానంలో రైతులందరు మాతో సహకరించి ఎన్నుకొన్న రకము ఐపిజివి 91114. ఈ రకము అనంతపురం జిల్లాకు అన్ని విధాల తగినది.

అన్నిటికంటే మేలైనదిగా ఎన్నుకోబడిన ఈ 91114 రకము మన అనంతపురం జిల్లాలో అనేక గ్రామాలలో సాగులో ఉన్నది. కాయ మరియు కట్టె (మేత) దిగుబడులకు, మేత నాణ్యతలను పెంపొందించడానికి రైతులు తప్పనిసరిగా సమగ్ర రోగ నివారణ పద్ధతిని పాటించాలి.

# అనంతపురం జిల్లాలో వేరుశనగ పంటనాశించు తెగుళ్ళ నమగ్ర రోగ నివారణ - రైతుల భాగస్వామ్యము

పి. లక్ష్మీరెడ్డి మరియు కె. లింకయ్య కుమార్

అనంతపురం జిల్లా రైతులకు వేరుశనగ పంట పండించుటలో చాలా అనుభవము ఉన్నది. ఇక్రిశాట్ వారితో కలిసి మేము వేరుశనగ పంటలో సమగ్రరోగ నివారణ పద్ధతులపై రైతుల పొలాలలో రైతుల భాగస్వామ్యముతో ప్రయోగాలు చేయడానికి లింగారెడ్డిపల్లి, తలువూరు, జలాలపురం గ్రామాలలోని కొంతమంది రైతులను ఎన్నుకున్నాము. ఐసిజివి 91114 అను స్వల్పకాలిక రకమునకు శిలీంధ్రనాశనితో (బావిస్టిన్ మరియు థైరమ్ (1:1 మిశ్రమము) విత్తనశుద్ధి మరియు విత్తిన 60-70 రోజుల మధ్యలో శిలీంధ్ర నాశనితో (బావిస్టిన్ 1 గ్రాము, 1 లీటరు నీరు) పిచికారి చేయుట ఈ సమగ్ర రోగ నివారణ పద్ధతిలోని ముఖ్యాంశములు.

ఈ జిల్లాలోని చాలామంది రైతులు ఇక్రిశాట్ వారు అభివృద్ధిపరిచిన సమగ్ర రోగ నివారణ పద్ధతిని పాటించి, అధిక కాయ మరియు మేత దిగుబడులను పొందినారు. మేత ఆరోగ్యవంతముగా ఉండి, పాడి పశువులకు మేపినపుడు పాల దిగుబడి కూడా పెరిగినది. ఈ సమగ్ర రోగ నివారణ పద్ధతిని పాటించుట వలన ఐసిజివి 91114, నాటు రకము కంటే ఒకటిన్నర రెట్లు కాయ మరియు మేత దిగుబడులు ఇచ్చినట్లు రైతులు చెప్పుచున్నారు. రైతుల పొలాలలో చేసిన ప్రయోగాలు ద్వారా మేము కూడా ఇదే విధమైన ఫలితాలను చూసినాము.

ఐసిజివి 91114 రకములో గింజ పెద్దగా ఉండి, తెగుళ్ళను కొంతవరకు తట్టుకుంటుంది. 90-95 రోజులలో పంట తీతకు వచ్చుచున్నది. ఈ సంగతులు చెప్పి కాళహస్తి, చిత్తూరు రైతులకు మీరు ఈ రకమును విత్తనముగా అమ్మవలెను. ఈ కొత్తరకము విత్తనాలను అభివృద్ధి చేయుటలో మేము పడిన శ్రమను రైతులు అర్థము చేసుకొనవలెను. పురుగులు, తెగుళ్ళు నివారించుటలో రైతులు సకాలంలో శ్రద్ధ చూపినట్లయితే, అధిక దిగుబడులు పొందుటకు అవకాశము ఉంటుంది. మేము చెప్పిన ఈ పద్ధతులను ఆచరించినట్లయితే తక్కువ కాలములో అభివృద్ధి పరచిన రకము ఐసిజివి 91114, ఇతర రైతులకు అందుబాటులోనికి వచ్చి, అధిక పంట మరియు మేత దిగుబడులు పొందుటకు అవకాశము ఉంటుంది.

## స్వల్పకాలిక వేరు శనగ రకము, ఐ సి జి వి 91114 - అనంతపురం జిల్లాలో విస్తరణ

### కె.ఎ. కలీం మరియు బి. రఘురామరెడ్డి

ఇక్రిశాట్ వారితో కలిసి రైతులకు అధిక దిగుబడులనిచ్చు వేరుశనగ రకము ఇవ్వాలనే ధ్యేయంతో మేము పనిచేయుచున్నాము. 2002 సంవత్సరంలో ఇక్రిశాట్ వారు పది వేరుశనగ రకములను మాకు ఇచ్చినారు. వాటిని దండువారిపల్లి మరియు రేకులకుంట గ్రామాలలో రైతుల భాగస్వామ్యంతో వారి పొలాల్లో ప్రయోగాలు చేసినాము. అందులో ఐసిజివి 91114, ఐసిజివి 89104 అను రెండు రకములు నాటు రకము కంటే అధిక దిగుబడులు ఇచ్చినట్లు రైతులు చెప్పినారు. ఇక్రిశాట్ వారి పరిశోధనలో కూడా ఈ రెండు రకాలు కూడా అధిక దిగుబడులు ఇచ్చినవి. ఆ సంవత్సరము వర్షములు సరిగా రాలేదు. అంత ఎక్కువ బెట్టలో కూడా వాటి ఆకులు వాడు పట్టకుండా పచ్చగా ఉన్నవి. ఎదుగుదల కూడా బాగుంది. వెస్ట్ నర్సాపురము అను గ్రామములో ఒక మహిళా రైతు తన 2 ఎకరాల పొలంలో ఐసిజివి 91114 రకమును పండించి, వచ్చిన 30 బస్తాలను తిరిగి విత్తనాలకే రైతులకు అమ్మినారు. ఐసిజివి 91114 రకములో మేత, కాయ దిగుబడి నాటు రకము కంటే ఎక్కువగా వచ్చినట్లు రైతులు గుర్తించినారు. మరియు ఈ కొత్తరకములో మేత ఎక్కువ దిగుబడే కాకుండా మంచి నాణ్యత కలిగి ఉంది. సమగ్ర రోగ నివారణ పద్ధతిని పాటించుట వలన తెగుళ్ళు తక్కువగా సోకటము దీనికి ముఖ్య కారణము. టిఎంవి 2 కాయల కంటే ఐసిజివి 91114 కాయలు, మరియు గింజలు కూడా లావుగా ఉండి ఎక్కువ బరువు ఉన్నవి. మేత నాణ్యత ఎక్కువగా ఉండుటవలన ఈ రకము మేతను పశువులు వదలకుండా తింటున్నాయని కూడా మహిళా రైతులు చెప్పినారు. ఒక రైతు 30 కిలోల 91114 కాయలు నుంచి 22 కిలోల విత్తనము రాగా, వాటిని నాటి 11 మూటలపైనే (440 కిలోలు) దిగుబడి వచ్చినట్లు చెప్పినారు. గత 3 సంవత్సరాలుగా ఈ రకము వర్షాభావ పరిస్థితిలో ఎక్కువ పంట పండినది. మా ఆర్.డి.టి. వాటరు షెడ్ గ్రామాల అన్నింటిలోను ఈ ఐసిజివి 91114 అను రకమును ఎక్కువమంది రైతులు పండించుచున్నారు. రైతులు ఈ రకము యొక్క కాయలను మరల రైతులకే విత్తనము కొరకు అమ్ముచున్నారు. ఈ విధముగా మా వాటరు షెడ్ గ్రామాలలో ఈ రకము విస్తరించుచున్నది.

# వేరు శనగ పంటలో యాజమాన్య పద్ధతులను పాటించుటలో అవకాశాలు - అవరోధాలు

వై. రమేష్

గత 25 సంవత్సరాలుగా రైతులు, మహిళలు, పరిశోధనా సంస్థల భాగస్వామ్యంతో పనిచేస్తున్న స్వచ్ఛంద సంస్థ మైరాడా, నీటి పరీవాహక ప్రాంతాలలో నీటిని అరికట్టు విధానము, వేరుశనగను వర్షాధారపు పంటగా పండించినపుడు రైతులకు సహాయ సహకారాలందించుట మా ముఖ్యమైన ఆశయములు. ఇక్రికాట్ వారు 1999 సం॥లో ఆకుమచ్చ తెగులును సమర్థవంతంగా అరికట్టుటకు రైతుల పొలాలలో వేసిన సమగ్ర రోగ నివారణ యాజమాన్య పద్ధతులతో కూడిన ప్రయోగాల వలన రైతులకు అధిక ఆదాయంతో పాటు ఆరోగ్యవంతమైన పశువుల మేత కూడా వచ్చినది. అప్పటినుండి రైతులు సమగ్ర రోగ నివారణ పద్ధతిని కొనసాగిస్తున్నారు. అలాగే జీప్సం వాడుక, దాని వలన లాభాలు, చీడపీడల నివారణ పద్ధతులు, అభివృద్ధి పరచిన విత్తన రకాలు వంటి విషయాలు మేము తెలిసుకుని రైతులకు అవగాహన కల్పిస్తున్నాము. రైతులకందుబాటులో ఉన్న పశువుల ఎరువును వినియోగించుట, చెరువులు, కుంటలలో పూడిక తీసి, ఆ మట్టిని పొలాలలో చల్లుట వంటి పద్ధతులను అనుసరించుట వలన మా ప్రాంతములోని రైతులకు 25 శాతం వరకు కాయ, మేత దిగుబడులు పెరిగినవి. చదరపు అడుగునకు 33 మొక్కల సాంద్రత వలన దిగుబడి అధికమువుతుందని ఇక్రికాట్ వారి ద్వారా తెలుసుకుని ఈ సాంద్రతను పాటించవలసినదిగా మా రైతులకు చెప్పుచున్నాము. మా రైతులు పైన చెప్పిన పద్ధతులను పాటించి వేరు శనగలో అధిక దిగుబడులు పొందుచున్నారు.

# రక్కను పీఠభూమిలో వేరుశనగ పంటనాశించు తెగుళ్ళ నియంత్రణలో రైతుల భాగస్వామ్యము - ఎన్.ఎ.టి.పి అనుభవాలు

ఎస్. దేశాయ్

వేరుశనగ పంటలో జీవ నిర్జీవ అవరోధాలను అరికట్టినట్లయితే అధిక దిగుబడులను సాధించవచ్చును. జీవ అవరోధాలలో తెగుళ్ళు చాలా ముఖ్యమైనవి. వాటిలో ఆకుమచ్చలు లేక 'టిక్క' తెగులు, ఆస్పర్జిలస్ కాండము కుళ్ళు తెగులు, కాండము మరియు కాయకుళ్ళు తెగులు, ముప్పకుళ్ళు తెగులు, ఇంకా ఈ మధ్యకాలంలో మన జిల్లాలో ఉధృతంగా వచ్చిన కాండం కుళ్ళు వైరస్ తెగులు చాలా ముఖ్యమైనవి. జాతీయ వ్యవసాయ సాంకేతిక పథకం (ఎన్ఎటిపి) ద్వారా అభివృద్ధిపరచిన పద్ధతులను భాగస్వామ్య విధానముతో రైతుల పొలాలలో ప్రయోగాలు చేశాము. ఈ ప్రయోగాలలో రైతులకు వివిధ తెగుళ్ళు గుర్తించుట, వాటిని సమర్థవంతంగా నివారించుట తెలిపినాము. వేరుశనగ పంటలో ఎఫ్లోటాక్సిన్ గురించి మన రాష్ట్రంలో ఒక శాతం రైతులకి మాత్రమే పూర్తి అవగాహన ఉంది. రైతులకు దీని అవగాహన అవసరము. గుజరాత్ రాష్ట్రములో రైతులు అభివృద్ధి పరచిన క్రొత్త వంగడాలపై మక్కువ చూపుతారు. కాని మన రాష్ట్రములో రైతులు పాత రకములనే వాడుచున్నారు.

ఐసిజివి 91114 వంటి మంచి వంగడాల విత్తనమును 'గోల్డ్ సీడ్' పేరుతో దేశం అంతటా అమ్ముడు కావాలి. మనమే వీటిని ఉత్పత్తి చేసుకుంటే విత్తనము కొనవలసిన అవసరము ఉండదు. కనుక ఈ జిల్లాలోని రైతులు అందరు సమగ్ర రోగ నివారణ పద్ధతులను పాటించి స్వల్పకాలిక రకము అయిన ఐసిజివి 91114ను వాడి అధిక కాయ, మేత దిగుబడులను పొందగలరని ఆశిస్తున్నాను.

## **వేరు శనగ పంటపై యాజమాన్య పద్ధతులు: రైతుల స్పందన**

**జి. పుల్లారెడ్డి (తలువూరు, ఆత్మకూరు మండలము, అనంతపురం జిల్లా)**

నేను ఈ సంవత్సరము ఐసిజివి. 91114 మరియు 92093 అను రెండు వేరుశనగ రకములను నాటినాను. ఆ రెండు రకముల విత్తనములు మరియు వాటి సమగ్ర రోగ నివారణ పద్ధతి, ఇక్రికాల్ శాస్త్రవేత్తల నుంచి పొందినాను. ఈ సంవత్సరము వర్షములు అనుకూలముగా ఉండుటవలన కాయ దిగుబడులు అధికముగా ఉన్నవి. ఆత్మర్థకరముగా, ఈ రెండు రకములలోను అకుమచ్చ తెగులు నాటు రకముకంటే తక్కువగా ఉండి, నాటు రకము కంటే అధిక దిగుబడులు ఇచ్చినవి. ఈ రకముల మేత ఆరోగ్యముగా ఉండుటయే కాక, దీనిని పాడి పశువులకు మేపుట వలన పాల దిగుబడి పెరిగినది. మా ఊరిలో చాలామంది రైతులకు ఇదే విధమైన ఫలితాలు వచ్చినవి. మా పొలములోని ఐసిజివి 92093 అను రకము ఐసిజివి 91114 అను రకముతో సమానంగా నూరు రోజులలో తీతకు వచ్చి మంచి ఆరోగ్యవంతమైన మేతను ఇచ్చినది.

**యస్. లింగారెడ్డి (జలాలపురం, బత్తులపల్లి మండలము, అనంతపురం జిల్లా)**

నాకు వేరుశనగ పంట పండించుటలో చాలా అనుభవము ఉన్నది. క్రిందటి 3 సంవత్సరముల నుండి జె.యల్. 24 అను నాటు రకముతో పాటు ఇక్రికాల్ వారు యిచ్చిన ఐసిజివి 91114 అను రకమును దాని సమగ్ర రోగ నివారణ పద్ధతిని పాటించి పండించినాను. ఈ పద్ధతిని పాటించుట వలన ఈ రకములో అకుమచ్చ తెగుళ్ళతోపాటు, కాయ మరియు కొమ్మ కుళ్ళు తెగులును కూడా కొంతవరకు అరికట్ట కలిగినాము. కాండము కుళ్ళు వైరస్ తెగులు నివారణకు ఏమీ చేయలేక పోవుచున్నాము. కాని వ్యాధి సోకకుండు జాగ్రత్తలు తీసుకొని సీంద్రియ పద్ధతులను పాటించినాను. రెండు విధములుగా (పంట దిగుబడి మరియు పశువులమేత) ఉపయోగపడు ఐసిజివి 91114 అను రకము జె.యల్ 24 అను నాటు రకము కంటే అధికమేత కాయ దిగుబడులు ఇచ్చినది. కావున ఈ కొత్త విత్తనమును మరి కొంతమంది తోటి రైతులకు ఇచ్చి మిగిలినది వ్యాపారులకు అమ్మినాను. ఈ అభివృద్ధి పరచిన ఐసిజివి 91114 నాటు రకము కంటే అధిక కాయ మరియు ఆరోగ్యవంతమైన మేతలను ఇచ్చుట వలన మా ఊరిలోని చాలామంది రైతులు చాలా సంతోషముగా ఉన్నారు. ఈ రకము మేత ఆరోగ్యముగా ఉండి, పాడి పశువులకు మేపుటవలన పాల దిగుబడి పెరిగినది.

**ఆర్. సూర్య చంద్రారెడ్డి (తలుపూరు, అత్మకూరు మండలము, అనంతపురం జిల్లా)**

నేను తలుపూరు గ్రామ రైతును. నాకు వేరుశనగ పంటలో 30 సంవత్సరముల అనుభవము ఉంది. ఈ రోజు వేరుశనగ సాగు పద్ధతులపై జరిగిన చర్చ అనంతపురం జిల్లా రైతులకు చాలా ఉపయోగము. సమయానుకూల పద్ధతులు వేరుశనగ పంటకు చాలా అవసరము. వేరుశనగ పంటకు అనుకూలమైన సమయములో వర్షములు పడినప్పటికీ, రైతు అభివృద్ధి పరచిన పద్ధతులను ముఖ్యముగా సమగ్ర రోగ నివారణ వంటి పద్ధతులు పాటించనట్లయితే, వేరుశనగ పంటకు నష్టము వాటిల్లును. ఈ రోజు శాస్త్రవేత్తలు, రైతులకు ఉపయోగపడు చిట్కాలు చెప్పినారు. నిజానికి, మన పూర్వీకులు వేరుశనగ పంట పండించుటలో చాలా విజ్ఞానము, అనుభవము కల్గి ఉండేవారు. మన పూర్వీకుల విజ్ఞానము మరియు అనుభవము వినయోగించుట మనకు తెలియక ప్రస్తుత రైతు సోదరులు అవసరమునకు మించి రసాయనాలను వాడి, వాతావరణమును కలుషితము చేయుచున్నారు. దీనివలన మనుషులకు, పశువులకు ఆరోగ్యము చెడి పోవుచున్నది. అధిక దిగుబడులు, నికరలాభాలు కొరకు మనము సామూహికముగా సమగ్ర రోగ నివారణ పద్ధతులను పాటించుట ముఖ్యము. ఈ విధమైన చర్చ రైతులకు, శాస్త్రవేత్తలకు మధ్య జరుగుట రైతులకు చాలా ఉపయోగము.

## తెగుళ్ళు సోకిన వేరుశనగ, జన్నచొప్పలతో పశువుల మేత - పోషకవిలువపై తెగుళ్ళ ప్రభావము

వై. రమణారెడ్డి, కె. శీవయ్య, టి. జనార్ధనరెడ్డి, యస్. పాండే మరియు  
యమ్. బ్లూమెల్

భారతదేశములో పశుగణ సంఖ్య 22 కోట్లు, గొట్టెలు 5.8 కోట్లు, మేకలు 12.5 కోట్లు. సాలీనా పాల ఉత్పత్తి 87 మిలియన్ టన్నులు. పరిమాణంలో మన దేశము ప్రపంచంలో మొదటిస్థానము. మన దేశంలో పశుగణ అభివృద్ధికి మేత లోపము ముఖ్యమైన అటంకము. పశువుల సంఖ్యకి, వాటికి లభించే మేతకు చాలా దగ్గర సంబంధము ఉన్నది. మన పశువులకు సరైన పోషణ అందించాలంటే పంట అవశేషాలను సరిగా వినియోగించుకోవాలి. జొన్న, వేరుశనగ పంటల మేత, పంట కోతకు ముందు, కోసిన తరవాత కూడా నాణ్యత చెడిపోయే అవకాశాలున్నాయి. పంటమీద శిలీంధ్రాల వలన కలుగు తెగుళ్ళు మరియు మేతను నిలువ చేయు విధానము దీనికి ముఖ్య కారణములు.

పరిశోధనాలయములో జరిపిన పరీక్షల ద్వారా తెగులు సోకిన జొన్న చొప్పలో 1.5 శాతము, వేరుశనగ కట్టెలో 2.34 శాతము మాంసకృత్తులు తగ్గినట్లు తెలిసినది. జీర్ణమయ్యే పిండి పదార్థాలలోను, జీర్ణంకాని పీచు పదార్థాలలోను కూడా వీటి ప్రభావము ఉంటుంది. అందులోను, వేరుశనగ పంట తెగుళ్ళుకి తొందరగా లోనయ్యే ప్రమాదము ఉంది. తెగులు ప్రభావము ఎక్కువగా మేత జీర్ణశక్తిపై ఉంటుంది.

పంటనాశించు తెగుళ్ళ ప్రభావము పశువుల పెరుగుదల, పాల దిగుబడి, పాలలో ఉన్న పోషక విలువలు పై ఎంతవరకు ఉంటుంది అను విషయములో ఇంకా ఎంతో పరిశోధనలు జరగాలి. పశువుల శరీరంలో సత్రజని ఏ విధముగా రసాయనిక చర్యల్లో మార్పులు చెందుతుంది అనేది కూడా గమనిస్తే వ్యాధులపై అవగాహన మరింతగా పెరగడానికి అవకాశం ఉంటుంది. పశువుల వ్యాధి నిరోధక శక్తిని పరీక్షించాలి. శిలీంధ్ర వ్యాధులు సోకిన మేత తినుట వలన పశువుల కాలేయము, మూత్రపిండాలు, గుండెలో కలిగే మార్పులను పరిశీలించాలి. ఏది ఏమైనా వ్యాధులను తట్టుకునే రకముల మేత పశువులకు మేపుట చాల ఉత్తమమైన పద్ధతి.

# వేరు శనగ మరియు జొన్న పంటల అవశేషాలు - మేతలో

## నాణ్యత

యమ్. బుల్లమెల్, ఏ. పార్థసారథి రావు, యన్. పాండె, మరియు

బి.వి.యస్. రెడ్డి

దక్షిణ ఆసియాలోని దేశాలలో భారతదేశములో పశువులు, గొర్రెలు, మేకలు సంఖ్య చాలా ఎక్కువ. వీటి ఉత్పత్తి మన దేశములో మిశ్రమ వ్యవసాయ పద్ధతిలో అంతర్భాగము. దక్కను పీఠభూమిలోని ఆంధ్రప్రదేశ్ రాష్ట్రములో రెండు రకములుగా (కాయ మరియు మేత) ఉపయోగపడు వేరుశనగ పంట ఈ పశుగణానికి కొంతమేరకు మేతను అందిస్తున్నది. వేరుశనగ కట్టె 50 శాతము కంటే అధికముగా మేతను అందించుచున్నది. మరియు 25 శాతము కంటే అధిక భాగము ఇతర మేతలతో బదలాయింపులు జరుగుచున్నవి. ఇది కాకుండా ఈ ప్రాంతపు రైతులు వరిగడ్డి, జొన్నచొప్పలను కూడా ఇతర గ్రామాల నించి కొనుచున్నారు. వేరుశనగలోని నాటు రకములకు ఆకు మచ్చ తెగుళ్ళు సోకి, పంట దిగుబడి, మేతలోని నాణ్యత విపరీతముగా తగ్గుచున్నది. రైతుల భాగస్వామ్యముతో పరీక్షలు జరిపి ఐసిజివి 91114 అను స్వల్పకాలిక రకము, యాజమాన్య పద్ధతులకు అనుగుణముగా స్పందించి కాయ మరియు మేత దిగుబడులు నాటు రకము కంటే అధికముగా ఇచ్చినది.

ఐసిజివి 91114 రకము మేతను పొడి పశువులకు మేపినపుడు 10 శాతము పాలు నాటు రకము మేతకంటే అధికముగా వచ్చినది. కనుక ఈ వేరుశనగ రకము ఐసిజివి 91114 వలన రైతులకు 3 లాభములు ఉన్నవి. 1. అధిక కాయ దిగుబడి, 2) అధిక మేత దిగుబడి, 3) అధిక పాల దిగుబడి.

ఇదే విధముగా జొన్నలో కూడా యస్ 35 అను రకము, మేతలో అధిక జీర్ణశక్తి గుణము కలిగి యున్నది. పివియస్ 16, సియస్వి 15 మరియు సియస్హెచ్ 16, రకముల మేతలో కూడా అధిక జీర్ణశక్తి కలుగజేయు గుణము ఉన్నది. రైతులు సాధారణముగా నాటు రకములోని మేతకు ఎక్కువ జీర్ణశక్తి ఉంటుంది అని అనుకొందురు. కాని అభివృద్ధి చేసిన పైన చెప్పిన జొన్న రకాలు మేత విషయములో నాటు రకము వలె ఉండి, అధిక గింజ దిగుబడులు కూడా ఇచ్చును.

## **తెగులు సోకిన మరియు ఆరోగ్యవంతమయిన వేరుశనగ మేత- రైతుల స్వందన**

**వి. రామలింగారెడ్డి (గుమ్మళ్ళకుంట, బత్తలపల్లి మండలము, అనంతపురం జిల్లా)**

ఇక్రికాట్ శాస్త్రవేత్తలు (సురేష్ పాండె మరియు నారాయణరావు) నాకు నాలుగు వేరుశనగ రకములు, ఐసిజివి 89104, ఐసిజివి 91114 (స్వల్పకాలిక రకములు) ఐసిజివి 92020, ఐసిజివి 92093 (మధ్యకాలిక రకములు) ఇచ్చినారు. ఈ నాలుగు రకములను నాటి వాటి యాజమాన్య పద్ధతులు పాటించినాను. కనుక నాకు అధిక కాయ (హెక్టారుకు 50-60 బస్తాలు, 40 కేజీలు బస్తా) మరియు మేత దిగుబడులు వచ్చినవి. ఈ రకములు చీడపీడలను తట్టుకొన్నవి. ఈ రకముల మేతను పశువులకు మేపి అధిక పాల దిగుబడి పొందినాను. ఈ మేత తినుటవలన మా ఎనుముల (గేదెలు) ఆరోగ్యము చాల మెరుగుబడినది.

ఐసిజివి 91114 అను రకము 90-95 రోజులలో తీతకు వచ్చినది. ఈ రకము మా రైతువారీ నాలు రకముకంటే బెట్టను (నీటి ఎద్దడిని) తట్టుకొన్నది. ఈ రకమును వర్షాధారముగాను నీటి వసతి కల పొలాలలోను పండించవచ్చును. ఐసిజివి 89104 రకమునకు కూడా దిగుబడి బాగానే ఉన్నది. కాని కాయ చిన్నగా ఉండుట వలన మా ప్రాంతపు రైతులకు ఇది నచ్చలేదు.

నా ఉద్దేశ్యంలో ఐసిజివి 92020 కూడా మంచి రకము. ఈ రకము చీడ పీడలను, రోగాలను తట్టుకొని ఎక్కువ కాయ ఆరోగ్యవంతమైన మేత ఇచ్చినది. ఈ రకము మధ్యకాలిక రకము కనుక దీనిని నీటి వసతి కల పొలాలలోనే పండించవలెను.

**పి. ఇందిరమ్మ (జలాలపురం, బత్తలపల్లి మండలము, అనంతపురం జిల్లా)**

ఐసిజివి 91114 రకము మేత పొడి పశువులకు చాల మంచిది. ఈ రకమునకు ఆకు మచ్చ తెగుళ్ళు తక్కువగా ఉండి, ఎక్కువ పచ్చని ఆకులు కలిగి యున్నది. ఈ రకము మేత తిన్న తరువాత మా ఎనుము (గేదె) అర్ధబీటరు పాలు ఎక్కువగా యిచ్చినది. మా నాలు రకము కంటి ఈ రకము ఒకటిన్నర రెట్లు ఎక్కువ కాయ దిగుబడి ఇచ్చినది మరియు 15 రోజులు ముందుగా తీతకు వచ్చినది. నేను 45 కేజీలు విత్తనాన్ని నాటి 35 బస్తాలు (40 కేజీ/బస్తా) దిగుబడి పొందినాను.

# రైతుల భారస్వామ్య పద్ధతిలో గ్రామీణ క్షేత్ర స్థాయిలో అంతర్జాతీయ పశుగణ పరిశోధనా సంస్థ (ఇప్రి)- అనుభవాలు

జి.వి. రెడ్డి

అరీడిటి / ఇప్రి అనంతపురం జిల్లాలో 12 గ్రామాలను ఈ పథకములో పని చేయుటకు ఎంపిక చేసినది. ఆ గ్రామాలలోని రైతులతో భాగస్వామ్య పద్ధతిలో పని చేయుట ద్వారా మాకు కొన్ని విషయాలు తెలిసినవి. అవి :

మెట్ట సేద్యము ఉండి, పశువులున్న ప్రతి రైతుకూ కొంత మేత కొరత ఉన్నది. దీనిని అధిగమించడానికి కొంత వరిగడ్డి, చుట్టుపక్కల గ్రామాలనుండి వేరుశనగ కట్టె, జొన్న చొప్పలను కొనుచున్నారు. ఈ జిల్లాలో మేత కొరత వల్ల పశువులను వ్యవసాయపు పనులు అయిన వెంటనే అమ్ముట, తిరిగి ప్రతి సంవత్సరము మరల కొనుట జరుగుచున్నది. గొట్టెలను అయకట్టు ప్రాంతాలకు తోలుకుని చోవటతో ఎరువు తగ్గుట వలన చంట దిగుబడి తక్కువ కావటం కూడా జరుగుచున్నది. దీనికి పరిష్కారమార్గముగా రైతులు చెప్పిన విషయాలు -

1. కాయ మరియు మేత ఎక్కువ దిగుబడినిచ్చు ఐసీజివి 91114 వంటి వేరుశనగ రకాలను వాడుట
2. ఉమ్మడి భూముల్లో మేతకి పనికి వచ్చు సుబాబుల్, అవిసె చెట్టులాంటివి పెంచుట
3. వంకలు, బావులు పక్క ఉన్న రైతులు పొలం చుట్టూ సుబాబుల్, అవిసె లాంటి చెట్లను పెంచుట

ఈ కార్యక్రమంలో భాగంగా ఐసీజివి 91114 విత్తనాన్ని రైతులకు ఇక్రిశాట్ వారి సహకారముతో ఇచ్చినాము. స్థానికంగా వాడుతున్న రకాని కంటే కాయ మరియు మేత దిగుబడి ఈ రకములో ఎక్కువ ఉన్నట్లు రైతులు చెప్పారు. పోషకపు విలువలు కూడా ఎక్కువగా ఉన్నవి. ఈ సంవత్సరము ఈ ఐసీజివి 91114 పై రైతుల నుంచి వచ్చిన అభిప్రాయాల ప్రకారముగా ఈ రకము మేత తిన్న పశువుల బరువు, పాల ఉత్పత్తి పెరిగినవి.

## వేరుశనగలో పంట తీత పద్ధతులు - యాజమాన్యము

### ఎస్. వసుంధర

ఆనంతపురం జిల్లాలో జులై మాసంలో వర్షాలు పడిన వెంటనే రైతులు వేరుశనగ పంటను విత్తుదురు. ఈ మధ్యకాలములో వర్షాలు తక్కువగా పడుచున్నాయి. కాబట్టి నేలలో తేమ ఎక్కువ కాలము ఉండుటలేదు. కనుక త్వరత్వరగా విత్తనాలు వేసుకోవలసి వచ్చుచున్నది. వేరుశనగ పైరు బెట్టికి గురి అయినప్పుడు పెరుగుదల చాలా తక్కువగా ఉండి కాలపరిమితి మనకి తెలియకుండానే పొడిగించబడుతుంది. నేల వాతావరణము, వర్షపాతము మొదలగువాటి మీద పంట కాలపరిమితి ఆధారపడి ఉంటుంది. మన జిల్లాలో పడే వర్షపాతాన్ని బెట్టని దృష్టిలో పెట్టుకుని కాయతీత సమయములో కొన్ని జాగ్రత్తలు తీసికొనుట మంచిది. 'టీక్కా' ఆకుమచ్చ తెగులును అరికట్టుటకు శీతాద్రవ్యాశని పిచికారి చేసినప్పుడు కాలపరిమితి కొంతవరకు పెరుగును. చెట్టు పచ్చదనము కోల్పోవంత వరకు తొందరపడి పంటను తీయవలసరము లేదు. ఇలా కొద్ది కాలము పంటను ఆపుట వలన కాయలోని గింజలు పెరిగి దిగుబడి పెరుగుతుంది. కాని మన రైతులు అకుమచ్చ తెగుళ్ల వలన పై ఆకులు పసుపురంగు తిరిగిన వెంటనే పంట కాల పరిమితి కానప్పటికీ పంటను తీసివేయుదురు. దీనివలన కాయలోని గింజ ఊరక దిగుబడి తగ్గుచున్నది. కనుక రైతులు పైన చెప్పిన పద్ధతులను పాటించినట్లయితే పూర్తి పంటను పొందుటకు అవకాశము ఉన్నది.

# ప్రస్తుత వేరుశనగ కాయ మరియు మేత అమ్మకాలలో అవకాశాలు - అవరోధాలు

## వి. రెడ్లప్పరెడ్డి

ప్రస్తుతము రైతులు చేస్తున్న వ్యవసాయ ఉత్పత్తుల అమ్మకాలలో కొన్ని మార్పులు అవసరము ఉంది. దీనికి ముందుగా రైతుల ఆలోచన విధానములో మార్పు రావాలి. ఏదైనా కొత్తరకము వస్తువు మార్కెట్లోకి వచ్చినప్పుడు దాని ధర ఎక్కువగా ఉంటుంది. అలాగే మాది మేలైన కొత్త రకము విత్తనము అని తోటి రైతులకు చెప్పి ఎక్కువ ధరతో తక్కువ మోతాదులో అమ్మాలి. అప్పుడే ఈ మేలు రకము విత్తనాలపై ఇతర రైతులకు ఆశక్తి ఉంటుంది. ఈ కొత్తరకము కాయలను నాణ్యతను బట్టి విత్తన కాయలని, నూనెకి వచ్చే కాయలని, కొంచెం చెడిపోయిన కాయలని ఇలా ఏర్పాటు చేసి అమ్మినట్లయితే లాభము ఎక్కువ వస్తుంది. ఏ రకమైన వస్తువుకైనా ప్రచారము (అడ్వర్టైస్మెంట్) అవసరము. మీ గ్రామాలలో 10వ తరగతి వరకు చదువుకున్న పిల్లలను పక్క గ్రామాలకు పంపించి ఈ కొత్తరకము విత్తనము మా దగ్గర ఉన్నది. మీరు వచ్చి పైరు ఎంత బాగున్నదో చూడండి. కాయ దిగుబడి, మేత దిగుబడి కూడా చాలా ఎక్కువగా ఉంటుంది అని ప్రచారము చేయాలి. ఆ పిల్లలకు అమ్మకాలలో కొంత శాతము ఇస్తామని చెప్పాలి. ఇలా చేసినట్లయితే, రైతులకు ఎక్కువ లాభాలు వచ్చే అవకాశము ఉంటుంది. రైతుల్లో సహకారము అవసరము. వేలు ఖర్చు పెట్టి బోర్డు వేసేకంటే అందరూ సహకరించుకుని ఒక పెద్ద పొలంలో కుంట తవ్వకుంటే జీవిత కాలం ఉపయోగిస్తుంది. అలాగే ఎర్ర గొంగళి వురుగును అందరూ కలిసి మంటలు పెట్టుకుని నాశనం చెయ్యవచ్చును.

## వేరుశనగ కాయ మరియు మేత అమ్మకము - రైతుల స్వందన

వై.రామలింగారెడ్డి (గుమ్మల కుంట, ఐతలపల్లి మండలం, అనంతపురం జిల్లా)

గ్రామస్థాయిలో వేరుశనగ ఉత్పత్తి అమ్మకాలలో మేము చాల కష్టాలను ఎదుర్కొంటున్నాము. మా ఊరులోనే అమ్మినట్లయితే సరుకును తీసికొని, తగిన దబ్బును సరిగా ఇవ్వరు. కాని తమిళనాడు నుంచి వచ్చిన మధ్యవర్తులు, ఒక బస్తాకు (40 కేజీలు) ఒక కేజీ కాయలు ఎక్కువ ఇచ్చినట్లయితే, రైతులకు వెంటనే రొట్టం ఇచ్చి సరకు తీసికొని వెళ్ళుచున్నారు. మాకు చాలకాలము నించి ఈ పద్ధతి బాగా నచ్చినది.

మేము సాధారణముగా టీయమ్వి-2 అను రకమును నూనె మిల్లుకు అమ్ముతాము. జె.యల్. 24 అను రకము మిల్లుతోబాటు గింజలు తినటానికి కూడా అమ్ముతాము. కాలహస్తీ నుంచి వర్తకులు నవంబరు/డిశంబరు నెలలలో మా దగ్గరకు వచ్చి ఒక బస్తా (40 కేజీలు) రూ. 800/- నుంచి 1000/- వరకు ఇచ్చి జె యల్ 24 అను రకమును కొనుచున్నారు. మేము సాధారణముగా వేరుశనగ కాయలుగా అమ్ముటకు ఇష్టపడుతాము. ఎందుకు అనగా ఇందులో కష్టము చాల తక్కువ. రైతుల దగ్గర కాయలు నుంచి గింజలు వేరు చేయు యంత్రములు ఉన్నట్లయితే, గింజలు అమ్ముట వలన, కాయ పొట్టు (కొక్కలు) మనకు ఉంటుంది. ఈ పొట్టు చాలా విలువైన ఎరువు. ఈ విధముగా గింజలు అమ్ముటవలన రవాణా ఖర్చులు కూడా తగ్గి, గింజలకు మంచి ధర కూడా వచ్చుచున్నది.

వేరుశనగ కాయలు బాగా ఊరినట్లయితే గింజలు అమ్ముట మంచి లాభము. ఒకవేళ, కాయలు బాగా ఊరక, నాశిగా ఉన్నట్లయితే కాయలను అమ్ముట మేలు. ఏది ఏమైనప్పటికీ, వేరు శనగ ఉత్పత్తిని అమ్ముటలో రైతులు తగిన నిర్ణయము తీసికొనుట మంచిది.

వేరుశనగలో కొత్త రకముల కాయలకు మధ్యవర్తులు చాల తక్కువ ధరలను ఇచ్చుచున్నారు. శాస్త్రవేత్తలను, రాష్ట్ర ప్రభుత్వ అధికారులను ఈ విషయమును పరిశీలించి, శ్రద్ధ వహించాలని కోరుచున్నాయి.

# రక్తను పీఠభూమిలోని పంట మరియు పశువుల మేత

## కొరకు జొన్న

### బి.వి.ఎస్. రెడ్డి

ముఖ్యముగా పశువుల మేతకు జొన్న చాలా మంచిది. జొన్న రెండున్నర మీటర్ల ఎత్తు పెరిగి ఎక్కువ మేతను ఇచ్చుచున్నది. ఎర్రనేలలు, నల్లనేలలు జొన్న పైరుకు అనుకూలము. ఇతర ప్రెక్షతో కలిపి అంతర పంటగాను మరియు పండ్ల తోటల మధ్యలోనూ వేసుకోవచ్చును.

జొన్నలో చాలా రకములు ఉన్నవి. పివికె 801లో ఎక్కువ గింజ తక్కువ చొప్ప, సిఎస్వి 15 లో ఎక్కువ చొప్ప మరియు ఎక్కువ గింజ వచ్చును. కనుక ఇది రెండు ఉపయోగముల పంట రకము. ఎక్కువ పిలకలు వచ్చే రకములలో కాండము సన్నగా ఉండి, పశువుల మేతకు బాగుంటుంది. జిడి 65174-2; జసి 2056-1 లాంటివి చాలా కొత్త రకాలు వచ్చినవి. కొత్తగా వచ్చిన తీపిరకము జొన్నతో బెల్లం, సారాయిలను కూడా తయారు చేసుకోవచ్చును. జొన్నతో సంకటి, రొట్టె మాత్రమే కాకుండా, అనేక రకాల పిండి పంటలు కూడా చేసుకోవచ్చును. బ్రెడ్, బిస్కట్లు కూడా కొందరిమధ్య జొన్నతో తయారు చేయుచున్నారు. కంకి పట్టక ముందే జొన్న కోసి పాడి పశువులకి మేపినట్లయితే పాల దిగుబడి ఎక్కువ అవుతుంది.

జొన్న 10, 15 రోజుల వయస్సులో కాండాన్ని చంపే పురుగు ఆశించి మువ్వ తెగులును కలుగచేస్తుంటుంది. ఈ మువ్వ తెగులు దిగుబడులను చాలా తగ్గిస్తుంది. అలాగే జొన్నలో గింజ పట్టేప్పుడు ఎక్కువగా వర్షం పడినట్లయితే గింజలు నల్లగా మారును. ఈ రెండు ఇబ్బందులనూ తట్టుకునే వంగడాలు ఇప్పుడు వాడుకలోనికి వచ్చినవి. సిఎస్ వి 15, పి ఎస్ వి 16 రకాలు పంట మరియు మేతను అధికముగా ఇచ్చును. సి ఎస్ హెచ్ 18 సంకర జాతి రకములో 16 శాతం చక్కెర ఉండి, హెక్టారుకు గింజలు 5 టన్నులు, చొప్ప 10 టన్నుల వరకు రావడమే కాకుండా గింజలు ముత్యాలవలె మెరుస్తూ ఉండును. నంద్యాల పరిశోధనా సంస్థ తయారు చేసిన ఎస్ పి జడ్ రకములో 19 శాతం చక్కెర ఉండి హెక్టారుకు 3 టన్నుల గింజలు, 10 టన్నుల చొప్ప వచ్చును. ఇక్రిశాట్ సౌజన్యంతో మహారాష్ట్ర వారు రూపొందించిన ఎస్ పి వి 1411 కూడా దీనిలాగే ఉంటుంది, ఇక్రిశాట్ తయారు చేసిన ఎస్ పి 422 రకము రెండవ పంట (రబీ సీజన్) కు అనుకూలముగా వుంటుంది. ఇందులో 20 శాతం చక్కెర ఉంటుంది. కేవలం పశువుల మేతకు ఉపయోగించుకునే రకాలు కూడా ఉన్నాయి. వెన్ను వచ్చిన వెంటనే పశువుల మేత కొరకు కోసి మళ్ళీ నీరు పెట్టి కొద్దిగా యూరియా వేసినట్లయితే పంట పెరుగుతు మూడు సార్లు కోతకు వచ్చును. ఇక్రిశాట్ అధిక గింజ మరియు చొప్ప దిగుబడులు మరియు క్రిమి కీటకాదులను తట్టుకును వంగదాలను రూపొందించుచున్నది. సంకర జాతి రకాలు తింటే ఒక్క నొప్పులని, ఆ మేత పశువులు బాగా తినవని రైతులలో ఒక అపోహ ఉంది. వాటిల్లో ఏ మాత్రం నిజం లేదని మా పరిశోధనలలో తేలినది. పంట దిగుబడి సంకరజాతి రకాలలో ఎక్కువ వస్తుంది. కనుక ఇవి రైతులకు లాభదాయకము.

# సుస్థిర వ్యవసాయమునకు విత్తనములు - ఎంపిక

## బ. శ్రీనివాస్

ఒడిదుడుకులు లేకుండా ఆశించిన మేరకు పంట రావడానికి విత్తనము కొంతవరకు సహాయ పడుతుంది. విత్తనము అనగా ఒక్క గింజలే కాదు. నారు, కటింగ్లు, పశుగ్రాసాలైతే ప్లెస్ట్, టిష్యూ కల్చర్ అయితే సెల్స్, జన్యుపరంగా తయారు చేసే విత్తనం ఇవన్నీ కూడా విత్తనం కిందికే వస్తాయి. దిగుబడి పెరగటానికి 40 శాతం వరకు విత్తనం దోహదం చేస్తుంది. ఎరువులు, యాజమాన్య విధానాలు అధిక దిగుబడులకు మిగిలిన దోహదకారులు. ఐసిజివి 91114 పది సంవత్సరాల కిందట వచ్చినా రైతులు దీన్ని గుర్తించడానికి ఇన్ని సంవత్సరాలు పట్టినది. సరైన సమయంలో విత్తనం, పోషకపదార్థాలు మరియు నీరు సమయానికి సరిగా అందించుట వంటివి పొటంచినట్లయితే మంచి విత్తనము అధిక దిగుబడులతో చక్కని ఫలితాలిస్తుంది.

జాతీయ వ్యవసాయ సంఘం బయటనించి వచ్చే కొత్త రకాల విత్తనాలని అంగీకరించేముందు తగిన జాగ్రత్తలు తీసుకోవాలని, మేలైన విత్తనాలకు పెట్టుబడులు పెట్టాలని చెప్పింది. విత్తన గ్రామాలు అభివృద్ధి చెయ్యాలి. తమకు కావలసిన కొత్తరకం విత్తనం వృద్ధి చేసి దానిని విత్తనంగా తోటి రైతులకు అమ్మినట్లయితే కొత్తరకము అభివృద్ధి చెందుతుంది. పది సంవత్సరాలుగా ఐసిజివి 91114 ని ప్రచారంలోకి తెచ్చి అనంతపురం జిల్లా రైతులకు తోడ్పడిన ఇక్రికాట్ వారు అభినందనీయులు.

# గ్రామ స్థాయిలో వేరుశనగ విత్తన ఉత్పత్తి అవకాశములు - అవరోధాలు

## ఎ. సత్యనారాయణ

విత్తనము బాగున్నట్లయితే పైరు బాగుండి అధిక దిగుబడులు పొందుటకు సాధ్యము అవుతుంది. విత్తనం చిన్నదైనంత మాత్రాన నాసికాదు. నిఖార్సు ముఖ్యం. మనదేశంలో సాలీనా 50,000 కోట్ల రూపాయల విత్తన వ్యాపారము జరుగుచున్నది. అందుకే స్వదేశీ సంస్థలతో పాటు విదేశీ సంస్థలు కూడా ఈ వ్యాపారము మన దేశంలో నడుపుతున్నారు. అదృష్టవశాత్తు మనదేశము, రైతుల హక్కుల్ని నిర్దేశిస్తూ ఒక నిర్ణయము తీసుకున్నది. రైతు తనకు కావలసిన విత్తనమును తాను పండించుకోవచ్చును. తెలిసిన తోటి రైతులకు ఇవ్వచ్చును. మంచి నాణ్యతగల విత్తనము మనము తయారు చేసుకోగలము అనే విశ్వాసము, ధైర్యము మన రైతుకు ఉన్నట్లయితే పెద్ద విత్తన సంస్థలన్నీ మూతపడతాయి. దానికి కావలసినది 'స్వంత విత్తనము' అనే భావన. ఇది మనదేశములో అనాదిగా ఉన్న పద్ధతే. 50 సంవత్సరాల పూర్వము రైతులు విత్తనాన్ని కొనేవారు కాదు. రైతు తన పంటలోని మంచి మొక్కల నుంచి గింజలు / కాయలు ఏరికొని విత్తనముగా వాడేవారు. కాని ఇప్పుడు పంటకాలము వచ్చేప్పటికి రైతులు విత్తనము కొనుచున్నారు.

అనంతపురం జిల్లాలో 20 లక్షల ఎకరాల్లో వేరుశనగ సాగులో ఉంది. ఎకరానికి సుమారు 100 కిలోల కాయలు విత్తనముగా పడుతుంది అని అనుకున్నా 20 కోట్ల కిలోలు అనగా 400 కోట్ల రూపాయలు కావాలి. మన స్వంత విత్తనము మనమే తయారు చేసికొన్నట్లయితే ఆ డబ్బు మన దగ్గరే ఉంటుంది కదా.

రెండోది "గ్రామ విత్తన కార్యక్రమము". (నీడ్ విలేజ్ కాన్సెప్ట్) ఒక గ్రామములో 5 లేక 6 గురు రైతులను ఎన్నుకొని వారికి ఫౌండేషన్ విత్తనము ఇచ్చి, దానిని వృద్ధిపరచి తక్కువ ఖర్చుతో విత్తనము రైతులకు సరఫరా చేయాలనేది ప్రభుత్వ ఆలోచన. ఎవరి విత్తనము వాళ్ళే తయారు చేసుకుంటే ఆ గ్రామము "విత్తన గ్రామము" అవుతుంది. మీ గ్రామములోని పంటకు విత్తనముగా విలువ పెరుగుతుంది. అన్ని గ్రామాల్లోనూ కాకుండా అనుకూలముగా ఉన్న గ్రామాల్లో ఈ కార్యక్రమము చేపట్టండి. అభివృద్ధి పరచిన ఐసిజివి 91114 ఒక కిలో విత్తనము ఇస్తే మీరే దాన్ని వృద్ధి చేయండి. ఇతర రైతులకు సరఫరా చేయండి. విత్తనము కోసము ఇతరుల పైన, ప్రభుత్వము పైన ఆధారపడవద్దు. అప్పుడే మన గ్రామములోని రైతులు అర్థికముగా అభివృద్ధి చెందుటకు అవకాశము ఉన్నది.

## గ్రామ స్థాయిలో విత్తన ఉత్పత్తి - రైతుల భావన

పి. పరమేశ్వరరెడ్డి (జిలాలపురం, బత్తలపల్లి మండలము, అనంతపురం జిల్లా)

సాధారణంగా కొద్దిమంది రైతులు వర్షాకాలపు పంటలోని మంచి వేరుశనగ కాయలను తీసి, నిల్వ ఉంచి తిరిగి వచ్చే వర్షాకాలములో విత్తనములుగా వాడుకొందురు. రైతు స్థాయిలో వేరుశనగ కాయలు నిల్వ ఉంచు పసతులు చాలా తక్కువగా ఉండుటవలన, చాలామంది రైతులు వాళ్ళ పంటను అమ్మి, మరుసటి సంవత్సరము విత్తనములను కొనుట ప్రస్తుతము జరుగుచున్న పద్ధతి.

కొద్దిమంది రైతులు మాత్రము పంట తీసిన తరువాత పొలములో బాగా ఆరబెట్టి, మంచి కాయలను తెంపి, మరుసటి సంవత్సరమునకు విత్తనముగా నిల్వ ఉంచుచున్నారు. బాగుగా ఆరిన కాయలను గోని సంచులలో నింపి, ఆ సంచులలో 'సల్ఫాస్' బిల్లలను పెట్టి పురుగు పట్టకుండా కాపాడుచున్నారు. ఈ "సల్ఫాస్" బిల్లలను అవసరమునుబట్టి మార్పుచుండుదురు. ఈ విత్తనమును రెండవ పంటకు (రబీ) కూడా వాడుదురు. ఈ రెండవ పంటలో (రబీ) లో వచ్చిన కాయలలోని గింజలు బాగా లావుగా పెరిగుట వలన కాయలు గట్టిగా ఉండును. సాధారణముగా నీటి వసతి ఉన్న రైతులు మాత్రమే ఈ రెండవ పంటను నవంబరు నెలలో విత్తుదురు.

కె. రామచంద్రారెడ్డి (ఆకులేడు, గార్లదిన్నె మండలము, అనంతపురం జిల్లా)

నాలుగు లేక ఐదు సంవత్సరముల క్రిందట వరకు మేము వర్షాకాలములో వచ్చిన పంటలో కొంత భాగము మరుసటి సంవత్సరము విత్తనము కొరకు నిల్వ ఉంచేవాళ్ళము. ఈ మధ్య కాలములో "ఊజి" అను క్రిములు నిల్వ ఉంచిన వేరు శనగ విత్తనములను నాశనము చేయుచున్నవి. దీని వలన మేము రాష్ట్ర వ్యవసాయ అధికారులపైన, రాష్ట్ర విత్తన అభివృద్ధి సంస్థ మొ॥ వాటిమీద విత్తనమునకు ఆధారపడవలసి ఉన్నది. ఈ "క్రిములను" అరికట్టు వద్దతులను మాకు సూచించినట్లయితే మాకు చాల ఉపయోగము.

## నిఘాంతులు

ఈ రెండు రోజుల చర్చలో ఈ కింది చెప్పిన అంశములు రైతులు, శాస్త్రవేత్తలు, ప్రభుత్వేతర సంస్థలు కలసి ఏకగ్రీవముగా నిర్ణయించినారు.

- త్వరితగతిన గ్రామస్థాయిలో ఐసిజివి 91114 రకము విత్తన ఉత్పత్తి మరియు రైతులకు సరఫరా చేయుట. దీనిలో ప్రభుత్వేతర సంస్థలు కీలక పాత్రను పోషించవలెను
- వేరు శనగ పంట ఉత్పత్తిని పెంచుతున్న సమగ్ర రోగ నివారణ పద్ధతిని ఇతర గ్రామాలకు వ్యాపింపచేయుట
- ఎస్ఫాటాక్లిన్ విషయంలో ఇంకా ప్రయోగాలు జరిపి, కాయలోను, మేతలోను ఈ రసాయనము లేని రకములను గుర్తించుట.
- రైతుల భాగస్వామ్యముతో రైతు పొలాలలో జరిగిన ఈ ప్రయోగాల ద్వారా వచ్చిన, అభివృద్ధిపరచిన వంగడాలను రాష్ట్రములోని వ్యవసాయ విశ్వవిద్యాలయము వారు విడుదల చేయుట
- రెండు విధములుగా ఉపయోగపడు (కాయ/గింజ మరియు మేత) వేరుశనగ, జొన్న రకాల సాగు పద్ధతిని ప్రోత్సహించుట
- చిన్న మధ్య కారు రైతుల వ్యవసాయంలో స్త్రీ పాత్రను అంచనావేసి, స్త్రీలు పాల్గొనేటట్లు ప్రోత్సహించుట
- ఈ పథకము వలన మన రైతులకు అనేక లాభములు కలిగినందువలన ఈ పథకమునకు రైతుల తరపున ప్రత్యేక అభివందనములు. ఈ పథకము ఇంకా కొనసాగినట్లయితే ఇంకా చాలా విషయాలు రైతులు అందుబాటులోకి వచ్చును. కాబట్టి ఈ పథకమును ఇంకా పొడిగించవలెనని మా కోరిక.





## About ICRISAT



The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is a nonprofit, non-political organization that does innovative agricultural research and capacity building for sustainable development with a wide array of partners across the globe. ICRISAT's mission is to help empower 600 million poor people to overcome hunger, poverty and a degraded environment in the dry tropics through better agriculture. ICRISAT belongs to the Alliance of Future Harvest Centers of the Consultative Group on International Agricultural Research (CGIAR).



## Contact information

ICRISAT-Patancheru  
(Headquarters)  
Patancheru 502 324  
Andhra Pradesh, India  
Tel +91 40 30713071  
Tel +91 40 30713071  
Fax +91 40 30713074  
icrisat@cgjar.org

Liaison Office  
CG Centers Block  
NASC Complex  
Dev Prakash Shastri Marg  
New Delhi 110 012, India  
Tel +91 11 25849552/25842553/25841294  
Fax +91 11 25841294

ICRISAT-Nairobi  
(Regional hub ESA)  
PO Box 39063, Nairobi, Kenya  
Tel +254 20 7224550  
Fax +254 20 7224001  
icrisat-nairobi@cgjar.org

ICRISAT-Niamey  
(Regional hub WCA)  
BP 12404  
Niamey, Niger (Via Paris)  
Tel +227 722529, 722725  
Fax +227 734329  
icrisatsc@cgjar.org

ICRISAT-Bamako  
BP 320  
Bamako, Mali  
Tel +223 2223375  
Fax +223 2228653  
icrisat-w-mali@cgjar.org

ICRISAT-Bulawayo  
Matopos Research Station  
PO Box 776,  
Bulawayo, Zimbabwe  
Tel +263 83 8311 to 15  
Fax +263 83 8253/8307  
icrisatw@cgjar.org

ICRISAT-Lilongwe  
Chitedze Agricultural Research Station  
PO Box 1096  
Lilongwe, Malawi  
Tel +265 1 707297/071/067/057  
Fax +265 1 707298  
icrisat-malawi@cgjar.org

ICRISAT-Maputo  
c/o INIA, Av. das FPLM No 2698  
Caixa Postal 1906  
Maputo, Mozambique  
Tel +256 21 461657  
Fax +258 21 461581  
icrisatmoz@panintra.com

Visit us at [www.icrisat.org](http://www.icrisat.org)