

RP - 05000

RP

RP 050008

LEGUMES ON - FARM TESTING AND NURSERY UNIT  
(LEGOFTEN)

00120

Report of Work  
(December 1987 - June 1988)



ICRISAT

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

1989

## CONTENTS

	<b>PAGE No.</b>
1. Staff List - LEGOPTEN	2
2. Acknowledgements	3
3. List of Tables	5
4. List of Appendices	11
5. Groundnut yield maximization trials in in India - Summary	12
6. Location-wise results and discussion	24
Maharashtra	24
Andhra Pradesh	37
Orissa	46
Gujarat	50
Tamil Nadu	55
Karnataka	66
7. Tables showing yields and cost of cultivation	77
8. Appendices	155

## **Legumes On-Farm Testing and Nursery Unit**

### **Staff List**

<b>Y.L. Nene</b>	<b>Program Director, Legumes</b>
<b>P.W. Amin</b>	<b>Coordinator</b>
<b>K.C. Jain</b>	<b>Breeder</b>
<b>J.V.D.K. Kumar Rao</b>	<b>Agronomist</b>
<b>C.S. Pawar</b>	<b>Entomologist</b>
<b>D.M. Pawar</b>	<b>Seeds Officer</b>
<b>V. Balarangaiah</b>	<b>Field Assistant (up to June 1988)</b>
<b>Y. Krishna Reddy</b>	<b>Field Assistant (From June 1988)</b>
<b>G. Sattaiah</b>	<b>Field Assistant</b>
<b>A. Bhaskar Rao</b>	<b>Field Assistant</b>
<b>M.S. Reddy</b>	<b>Field Attendent</b>
<b>A. Gafoor</b>	<b>Field Attendant</b>
<b>B. Eliah</b>	<b>Field Attendent</b>
<b>R.N. Chandekar</b>	<b>Field Attendent</b>
<b>M. Pentaiah</b>	<b>Field Attendent</b>
<b>P. Prabhakar</b>	<b>Field Attendent</b>
<b>V.V. Rao</b>	<b>Clerk/Typist</b>

## Acknowledgements

We gratefully acknowledge the contributions made by policy-makers, administrators, ICRISAT scientists, staff of the Training and Visit System and the Department of Agriculture of various states.

Union Ministry of Agriculture: M.V. Rao, P.V. Shenoi, T.V. Sampath, S.S. Khanna, M.D. Wasnik,

ICRISAT: D. McDonald, S.N. Nigam, R.Jambunathan, J.H. Williams, T.S. Walker, D.L. Oswalt, S.M. Virmani, D.S. Bisht, R.C. Nageswar Rao, L.J. Reddy, V.M. Ramraj, V.K. Mehan, K.L. Sahrawat, Sardar Singh, N.K. Awadhwal, M. Prabhakar Reddy, A. Ramakrishna, A.K.S. Huda, S.B. Sharma,

Maharashtra: V.S. Dhumal, M.V. Sant, J. Dhale, V.L. Hardikar, Vasant Sapkal, P. Firke, J. Raut, W.K. Asole, P.T. Gadekar, W.C. Bhagat, K. Lavekar, M.V. Kasbe, D.D. Deshmukh, P.S. Deshkar, L.R. Sutar,

Tamil Nadu: R. Mani, C. Soundrarajan, K. Sibi, M.Ramakrishna, A.S. Nana Batcha, J. Ayyadurai,

Andhra Pradesh: S.K. Arora, M.A. Rehaman, Abdul Qayyum, D. Pollaiah, K.Y.L. Narsimha Rao, V. Ramachandraiah, Shiv Shastri,

Karnataka: P. Bhimaiah, Y. Chandrakeerti, Dilip Rau, K.V. Sarvesh, P. Nagaraj, Keshav Murthi, A. Thippanna, Narsimha Rao, Vekatesh Murthy,

**Gujarat: L.T. Salia,**

**Orissa: R.N. Mohanty, R.C. Mishra, R.C. Sahu, B.N. Rath, N. Pradhan and Balier Singh.**

Special thanks are due to L.D. Swindale and J.S. Kanwar of ICRISAT for their encouragement. We are grateful to K.B. Srinivasan of ICRISAT for his effective liaison with various officials and his keen interest in the transfer of technology.

**LEGOPTEN Staff**

## List of Tables

Table		Page
1	Groundnut varieties used in yield maximization trials, postrainy season, 1987-88	77
2	Sowing dates for ICRISAT and State plots at different locations, postrainy season, 1987-88	78
3	Seeding rates (kg ha <sup>-1</sup> ) used in groundnut trials at various locations, postrainy season, 1987-88	79
4	Plant densities (1000 ha <sup>-1</sup> ) in the ICRISAT and State plots postrainy season, 1987-88	80
5	Location-wise dry pod yield (t ha <sup>-1</sup> ) of groundnut, postrainy season, 1987-88	81
5A	Two way table of comparison of average dry pod yield of groundnut between varieties and cultivation practices	82
6	Shelling percentage of groundnut harvested in trial plots, postrainy season, 1987-88	83
7	1000 kernel weight (g) of groundnut harvested in trial plots, postrainy season, 1987-88	84
7A	Two way comparison of 1000 kernel weight between two methods of cultivation and two varieties, postrainy season, 1987-88	85
8	Oil content (%) of groundnut harvested in trial plots, postrainy season, 1987-88	86
9	Dry haulm weight (t ha <sup>-1</sup> ) of groundnut harvested in trial plots, postrainy season, 1987-88	87
10	Cost of cultivation (Rs ha <sup>-1</sup> ) of groundnut in trial plots, postrainy season, 1987-88	88
11	Duration of ICRISAT and State groundnut varieties at different locations, postrainy season, 1987-88	89
12	Summary of groundnut trial data, postrainy season, 1987-88	90
13	Comparison of yield parameters of improved and common varieties under the State method of cultivation, postrainy season, 1987-88	91

14	Comparison of the ICRISAT and the State method of cultivation in relation to yield parameters, post-rainy season, 1987-88	92
15	Comparison of ICRISAT method and ICRISAT variety with the State method and State variety in relation to yield parameters, post-rainy season, 1987-88	93
16	Yields of groundnut under different fertilizers in farmers' fields, Parbhani district, Maharashtra, post-rainy season, 1987-88	94
16A	Results from trials in farmers' fields, Dhule district, Maharashtra, post-rainy season, 1987-88	95
17	Characteristics of the selected fields in Maharashtra	96
18	Locations of groundnut yield maximization trials in Maharashtra, post-rainy season, 1987-88	97
19	Daily minimum and maximum temperatures from sowing (15 Nov 1987) till pod development (9 Feb 1988), Taluka Seed Farm, Dhanora, Amraoti district, Maharashtra, post-rainy season, 1987-88	98
20	Plant density, yield and ancillary data from groundnut trial at Taluka Seed Farm, Dhanora, Amraoti district, Maharashtra, post-rainy season, 1987-88	100
21	Comparison of operations/inputs used in the ICRISAT method and the State method, yields and cost of cultivation, Taluka Seed Farm, Dhanora, Amraoti district, Maharashtra, post-rainy season, 1987-88	101
22	Cost of cultivation in groundnut trials, Taluka Seed Farm, Dhanora, Amraoti district, Maharashtra, post-rainy season, 1987-88	102
23	Labor used in the ICRISAT and the State method, Taluka Seed Farm, Dhanora, Amraoti district, post-rainy season, 1987-88	103
24	Cost of fertilizers used in the ICRISAT and State methods of groundnut cultivation at Taluka Seed Farm, Dhanora, Amraoti district, post-rainy season, 1987-88	104

25	Cost of weeding and interculture in ICRISAT and State method of groundnut cultivation, Taluka Seed Farm, Dhanora, Amraoti district, Maharashtra, postrainy season, 1987-88	105
26	Soil analysis data, Taluka Seed Farm, Basmat, Parbhani district, Maharashtra, postrainy season, 1987-88	106
27	Plant density, yield and ancillary data from groundnut trials at Taluka Seed Farm, Basmat, Parbhani district, Maharashtra, postrainy season, 1987-88	107
28	Plant density, yield and ancillary data from groundnut trials at Taluka Seed Farm, Basmat, Parbhani district, Maharashtra, postrainy season, 1987-88	108
29	Yield and ancillary data for groundnut trials on Chikhalthana Seed Farm and farmers' fields, Parbhani district, Maharashtra, postrainy season, 1987-88	109
30	Plant density, yield and ancillary data from groundnut trials at Akluj, Solapur district, Maharashtra, postrainy season, 1987-88	110
31	Cost of cultivation in groundnut trials, Taluka Seed Farm, Akluj, Solapur district, Maharashtra, postrainy season, 1987-88	111
32	Effect of different cultivation practices on groundnut cv. JL 24 yield and other parameters, Agricultural University Research Farm, Dapoli, Ratnagiri district, Maharashtra, postrainy season, 1987-88	112
33	Results of partial adoption of ICRISAT technology on farmers' fields, Parbhani district, Maharashtra, postrainy season, 1987-88	113
34	Soil analysis data from Andhra Pradesh	114
35	Plant density, yield and ancillary data from groundnut trials, at the State Seed Farm, Tangadencha, Kurnool district, Andhra Pradesh, postrainy season, 1987-88	115
36	Cost of cultivation for groundnut trials at the State Seed Farm, Tangadencha, Kurnool district, Andhra Pradesh, postrainy season, 1987-88	116



37	Plant density, yield and ancillary data from groundnut trials, at the Project Demonstration and Development Farm, Yemmiqannur, Kurnool district, Andhra Pradesh, post-rainy season, 1987-88	117
38	Cost of cultivation in ICRISAT and State method of groundnut cultivation, Yemmiqannur, Kurnool district, Andhra Pradesh, post-rainy season, 1987-88	118
39	Plant density, yield and ancillary data from groundnut trials at the Project Development and Demonstration Farm, Mahadeomanqalam, Chittoor district, Andhra Pradesh, post-rainy season 1987-88	119
40	Cost of cultivation for groundnut trials at Mahadeomanqalam, Chittoor district, Andhra Pradesh, post-rainy season, 1987-88	120
41	Plant density, yield and ancillary data from groundnut trials, at the Project Development and Demonstration Farm, Garikapadu, Krishna district, Andhra Pradesh, post-rainy season, 1987-88	121
42	Cost of cultivation for groundnut trials at the Project Development and Demonstration Farm, Garikapadu, Krishna district, Andhra Pradesh, post-rainy season, 1987-88	122
43	Chemical analysis of soils at sowing at trial locations in Orissa, post-rainy season, 1987-88	123
44	Plant density, yield and ancillary data of groundnut trials at Khurda, Puri district, Orissa, post-rainy season, 1987-88	124
45	Cost of cultivation of groundnut, at Khurda, Puri district, Orissa, post-rainy season, 1987-88	125
46	Plant density, yield and ancillary data of groundnut trials at Sakhiqopal, Puri district, Orissa, post-rainy season, 1987-88	126
47	Cost of cultivation of groundnut yield maximization trials at Sakhiqopal, Puri district, Orissa, post-rainy season, 1987-88	127
48	Statement showing area and average yield per hectare of post-rainy groundnut in Kheda district of Gujarat from 1983-87	128

49	Physical and chemical properties of soils in Kheda district, Gujarat	129
50	Plant density, yields and ancillary data for groundnut yield maximization trials at Nadiad, Gujarat, post-rainy season, 1987-88	130
51	Cost of cultivation in groundnut yield trials at Taluka Seed Farm, Nadiad, Kheda district, Gujarat, post-rainy season 1987-88	131
52	Plant density, yields and ancillary data for groundnut trials at Boriavi, Gujarat, post-rainy season, 1987-88	132
53	Cost of cultivation in groundnut yield trials at Taluka Seed Farm, Boriavi, Kheda district, Gujarat, post-rainy season, 1987-88	133
54	Package of practices followed for groundnut yield maximization trials, Musaravakkam, Chengalput district, Tamil Nadu, post-rainy season, 1987-88	134
55	Plant density, yield and ancillary data from groundnut trials, Musaravakkam, Chengalput district, Tamil Nadu, post-rainy season, 1987-88	135
56	Cost of cultivation of groundnut yield maximization trials, Musaravakkam, Chengalput district, Tamil Nadu, post-rainy season, 1987-88	136
57	Package of practices followed for groundnut yield maximization trials at Putlur, Chengalput district, Tamil Nadu, post-rainy season 1987-88	137
58	Plant density, yield and ancillary data from groundnut trials, Putlur, Chengalput district, Tamil Nadu, post-rainy season, 1987-88	138
59	Cost of cultivation of groundnut yield maximization trials, Putlur, Chengalput district, Tamil Nadu, post-rainy season, 1987-88	139
60	Package of practices followed for groundnut yield maximization trials, Neyveli, South Arcot district, Tamil Nadu, post-rainy season, 1987-88	140
61	Plant density, yield and ancillary data of groundnut yield maximization trials, Neyveli, South Arcot district, Tamil Nadu, post-rainy season, 1987-88	141

62	Cost of cultivation of groundnut yield maximization trials, Neyveli, South Arcot district, Tamil Nadu, post-rainy season 1987-88	142
63	Cost of cultivation and yield of groundnut in farmers' field, Rettanai, South Arcot district, Tamil Nadu, post-rainy season, 1987-88	143
64	Package of practices followed for groundnut yield maximization trials, Guladhalli, Raichur district, Karnataka	144
65	Plant density, yield and ancillary data of groundnut yield maximization trials, Guladhalli, Raichur district, Karnataka, post-rainy season, 1987-88	145
66	Cost of cultivation of groundnut yield maximization trials, Guladhalli, Raichur district, Karnataka, post-rainy season, 1987-88	146
67	Package of practices followed for groundnut yield maximization trials, Turkondona, Raichur district, post-rainy season, 1987-88	147
68	Yield and ancillary data for groundnut yield maximization trials at Turkondona, Raichur district, Karnataka, post-rainy season, 1987-88	148
69	Cost of cultivation of groundnut yield maximization trials, Turkondona, Raichur district, Karnataka, post-rainy season, 1987-88	149
70	Package of practices followed for groundnut yield maximization trials, R.K. Shala, Bangalore district, Karnataka, post-rainy season 1987-88	150
71	Plant density, yield and ancillary data for groundnut trials at R.K. Shala, Bangalore district, Karnataka, post-rainy season 1987-88	151
72	Cost of cultivation of groundnut yield maximization trials, R.K. Shala, Bangalore district, Karnataka, post-rainy season, 1987-88	152
73	Package of practices followed by the farmer to grow TMV 2 under ICRISAT and State methods, Kalamala, Manvi Taluka, Raichur district, Karnataka, post-rainy season, 1987-88	153
74	Cost of cultivation of TMV 2 in farmer's field under ICRISAT and State methods, Kalamala, Manvi Taluka, Raichur district, Karnataka, post-rainy season, 1987-88	154

## List of Appendices

S.No.		Page
1	Map of India showing groundnut yield maximization trial locations, postrainy season, 1987-88	155
2	Map of India showing Soil pH at different trial locations, postrainy season, 1987-88	156
3	Map of India showing Phosphorus status in soil at different trial locations, postrainy season, 1987-88	157
4	Map of India showing Potash status in soils at different trial locations, postrainy season, 1987-88	158
5	Map of India showing Zinc content in soils at different trial locations, postrainy season, 1987-88	159
6	Map of India showing Iron status in soils at different trial locations, postrainy season, 1987-88	160
7	Maps of different states showing soil types and rainfall	
	Maharashtra	161
	Andhra Pradesh	162
	Orissa	163
	Gujarat	164
	Tamil Nadu	165
	Karnataka	166



## **GROUNDNUT YIELD MAXIMIZATION TRIALS IN INDIA**

**Postrainy season 1987-88**

### **SUMMARY**

The postrainy season trials were a continuation of the 1987 rainy season trials, with modification in treatments. There were four treatments:

1. ICRISAT recommended package of practices with ICRISAT variety (ICRISAT method),
2. ICRISAT recommended package of practices with State variety (ICRISAT method),
3. State recommended package of practices with ICRISAT variety (State method), and
4. State recommended package of practices with State variety (State method).

The trials, aimed at obtaining maximum yields while lowering the cost of cultivation, were organized in six states (Fig.1): Andhra Pradesh (4), Karnataka (3), Gujarat (2), Maharashtra (6), Orissa (2), and Tamil Nadu (3). Out of a total of 20 trials, 14 were successful. Six trials failed due to the following causes: Andhra Pradesh: Mahadeomangalam (frequent water shortage), Carikapadu (poor seed emergence); Maharashtra: Saidapur (severe bud necrosis disease), Dhule (water shortage); Gujarat: Nadiad (poor seed germination) and Borjavi (high salinity).

The locations of trials in various states are shown in Fig. 1. The varieties recommended by ICRISAT for the post-rainy season were ICGS 44 and ICGS 11. The state varieties were TMV 2 and JL 24 in Andhra Pradesh; S 206, KRG 1, and TMV 2 in Karnataka, CO 2 in Tamil Nadu, AK 12-24 in Orissa, SB XI in Maharashtra; and G 2 in Gujarat (Table 1).

Except in Maharashtra, sowings in all other states were done in the month of December. In Maharashtra the common practice is to sow groundnut during January-February. Three trials were sown in this month. However, the trial at Taluka Seed Farm, Dhanora, Amravati, was sown in November (Table 2).

Seeding rates ranged from 98 - 150 kg ha<sup>-1</sup> in the ICRISAT method with an average of 129.2 kg ha<sup>-1</sup> for the ICRISAT variety and 127.2 kg ha<sup>-1</sup> for the State variety. For the State method, the seed rate ranged from 120-150 kg ha<sup>-1</sup> for both varieties with an average of 137.3 kg ha<sup>-1</sup> for the ICRISAT variety and 136.0 kg ha<sup>-1</sup> for the State variety (Table 3). Notwithstanding the higher seeding rates used in the state method, the plant density at harvest was lower or on par with that in the ICRISAT method (Table 4).

#### Yields:

At all 14 locations the ICRISAT variety with ICRISAT method gave higher yields than the State variety under the same method (Table 5). The percentage increase in yield

for the ICRISAT variety over the State variety was 43.4% when ICRISAT method was used and 31.3% when the State variety was used (Table 5 A). In absolute terms the ICRISAT variety gave a higher yield by 1.156 t ha<sup>-1</sup> over the State variety when ICRISAT method was practiced, and by 0.704 t ha<sup>-1</sup> when the State method was followed. The highest yield for ICRISAT variety and the ICRISAT method of 5.26 t ha<sup>-1</sup> was recorded at Basmat (light shallow Vertisol, January sowing, light irrigation with sprinklers, and without added nitrogen). At five other locations yields of over 4.3 t ha<sup>-1</sup> were recorded. The lowest yield of 2.28 t ha<sup>-1</sup> for the ICRISAT variety in the ICRISAT method was recorded at Musaravakkam in Tamil Nadu. The highest yield for the State variety of 3.57 t ha<sup>-1</sup> was for TMV 2 at Tangadencha when ICRISAT method was used; the yield level was over 3.0 t ha<sup>-1</sup> at five other locations. Under the State method the yield range for the ICRISAT variety was between 1.60 to 4.31 t ha<sup>-1</sup> and for the State variety it was between 0.56 and 3.18 t ha<sup>-1</sup>. The low yields in the State variety SB XI at Akluj were due to its susceptibility to bud necrosis disease (BND). ICGS 11 has field resistance to this disease. At Turkondora, KRC 1 was more susceptible to BND than ICGS 44; however, FRC 1 was much less affected by BND in ICRISAT method than in the State method. Optimum plant density in the ICRISAT method may be one of the reasons for low incidence of BND.



**Shelling percentage:** Shelling percentage (Table 6) was highest (74.78%) under the ICRISAT method for the ICRISAT variety followed by the ICRISAT method for the State variety (72.80%). Under the State method, the State variety had 71.60% shelling compared to 70.70% for the ICRISAT variety. The ICRISAT variety showed much higher improvement in shelling (5.77%) than the same variety under the State method. The State variety under ICRISAT method also gave a higher shelling than the same variety under the State method; however, the increase was only marginal (1.67%). At five locations - Tangadencha (Andhra Pradesh), Guladhalla, Turkondona and R.K. Shala (Karnataka), and Neyveli (Tamil Nadu), the increase in shelling for ICRISAT variety ranged between 6-10% over the same variety under the State method. At Neyveli, the State variety CO 2 also showed an increase of 8% in shelling in ICRISAT method over the State method.

**Kernel weight:** There was phenomenal increase in kernel weight for both varieties under the ICRISAT method (Table 7). The ICRISAT method gave an average increase of 13.36% over the State method. When kernel weight of the ICRISAT variety under ICRISAT method was compared with the same variety in the State method, the former had higher kernel weight by 16.45%. For the State varieties 1000 kernel weight was higher by 9.62% in the ICRISAT method over the State method. Clearly, the ICRISAT method was far superior to the State method in giving higher kernel weight.

**Oil content:** ICRISAT varieties also had larger seed size than the State varieties (Table 7 A). There was an overall increase in oil content when the ICRISAT method was practiced (Table 8). The ICRISAT variety under ICRISAT method gave 0.92% higher oil content than the same variety under the State method. The State variety under ICRISAT method gave 0.7% more oil content than the same variety under the State method.

**Haulm weight:** Haulm weight was similar in both varieties and under both methods of cultivation (Table 9). There was no consistent pattern except at Akluj and Turkondona where bud necrosis disease suppressed the growth of the crop, resulting in reduced haulm weight.

**Cultivation costs:** The cost of cultivation (Table 10) was more in ICRISAT method than in the State method by about 15.3%. In absolute terms, it was higher by about Rs.1250 ha<sup>-1</sup>. With the ICRISAT method average yields were higher by about 400 kg ha<sup>-1</sup> for the State varieties and 900 kg ha<sup>-1</sup> for the ICRISAT varieties (Table 5A). If treatment 1 (ICRISAT variety and method) is compared with treatment 4 (State variety and method), the average increase in yields obtained in treatment 1 over that in treatment 4 was about 1600 kg ha<sup>-1</sup>, for an additional investment of about Rs.1400 ha<sup>-1</sup>. The cost of cultivation in the ICRISAT method would have been lower, but for the trial at Sakhigopal in Orissa where the costs computed appear to be unrealistic.

It was expected that ICRISAT varieties, because of their virginia background would mature later than traditional spanish varieties. However, the data (Table 11) shows that their maturity duration was comparable to local varieties. The shortest maturity duration (100-108 days) was observed in Tamil Nadu.

### Yield Comparisons

The summary of the yield parameters and the cost of cultivation is given in Table 12. When the yield parameters of the ICRISAT variety were compared with that of the State variety, both grown under the State method, the ICRISAT variety was far superior to the State variety in yield and 1000 kernel weight (Table 13). It had a slightly lower shelling and marginally higher oil content. When the two methods were compared, the ICRISAT method of cultivation resulted in notable improvement in yield, shelling, 1000 kernel weight and oil content (Table 14).

The best combination was that of the ICRISAT variety and the ICRISAT method (Table 15). This combination showed phenomenal increase of 69.64% in dry pod yield, 4.44% in shelling, 42.16% in 1000 kernel weight and 1.44% in oil content (Table 15).

The results described in this report are from the research farms. Whether these yield levels could be obtained on farmers' fields would have bearing on the extent of adoption of the ICRISAT method.

### **Trials on farmers' fields**

The State Department of Agriculture of Maharashtra conducted 54 trials in farmers' fields using the common variety and different fertilizer regimes. The most economic regime was that recommended by ICRIASAT, single super phosphate (500 kg ha<sup>-1</sup>) + gypsum (400 kg ha<sup>-1</sup>). Investment in nitrogenous fertilizers did not increase the profits. (Table 16). The results from 31 trials in farmers' fields in Dhule district also showed substantial increase in yield when the ICRIASAT method was adopted (Table 16 A).

### **Constraints to Increasing Yields**

Some constraints that need to be overcome in increasing groundnut productivity are as follows:

**Soil pH:** In most soils of the Deccan Plateau, the pH is high, at around 8.0. (Fig. 2). The high pH means reduced availability of several nutritional elements such as phosphorus, zinc, and iron. In parts of Tamil Nadu and Orissa, the soil pH was low. Liming of these soils may increase yields. The soil pH in Chittoor district of Andhra Pradesh ranged between 6.5 and 7.0 and this was ideal for groundnut.

**Excessive use of nitrogen:** Most farmers use 20 kg N as basal plus another 15-20 kg N as top dressing. Excessive nitrogen results in excessive vegetative growth, poor nodulation, and higher susceptibility to pests and diseases resulting in low yields (Table 16).

**Improper sowing method:** The current method of seeding using local seed drills leads to higher seeding rates. Because the seed distribution and seeding depth are not uniform many seedlings fail to emerge and there are gaps in the crop stand. Such crops are more prone to BND. The establishment of good plant stand with lower seeding rates is of prime importance.

**High seeding rates:** Many farmers use seeding rates in excess of 150 kg seed ha<sup>-1</sup>. However, the plant stand establishment is not optimum. Increase in seeding rates alone will not ensure a good crop establishment, unless the sowing method is changed or proper seed-drills are developed.

**Phosphorus deficiency:** Most soils are deficient in phosphorus. (Fig. 3). Increased use of phosphorus will increase the fertility of soils to benefit most crops.

**Improper phosphatic carriers:** Phosphorus is mostly applied through diammonium phosphate (DAP). Changing the phosphorus source from DAP to single super phosphate (SSP) and with gypsum, has an extremely beneficial effect on yields (Table 16). Single super phosphate also supplies calcium (19.5%), sulphur (12.5%) and magnesium to the groundnut crop. SSP is now available in a granular form. Placement in seed furrows is a better method of application than the broadcast method.

**Potash deficiency:** Soils at the trial locations are rich in potash. However, some soils in Tamil Nadu, Orissa, Karnataka and Andhra Pradesh may need potash application (Fig. 4).

**Calcium deficiency:** We do not have data on calcium deficiency except from parts of Kheda and Kutch regions of Gujarat. However, wherever gypsum was used both yields and pod filling were improved (Table 16).

**Zinc deficiency:** Zinc was found deficient in most soils where pH was high (Fig. 5).

**Iron deficiency:** Most soils are deficient in iron resulting in chlorotic foliage (Fig. 6).

**Improper seedbeds:** The present method of sowing groundnut in flat lands is not suitable as this results in poor root development and nodulation. This results in lower up-take of nutrients. As the fields are not levelled, water-logging is a common problem. The yields from water-logged patches are very low. Higher seedling mortality is also associated with flat seedbeds. Use of raised beds and furrows increases the yield by 15-31%.

**Weeds:** This is major problem in most areas. Weeding is a major cost factor in groundnut cultivation and reduces the profit.

**Irrigation method:** Flooding of fields for irrigation results in poor root growth and poor nodulation.

**Harvest problems:** Groundnut harvest from flat land leaves 15 to 20% pods in the soil.

**Labor:** Labor shortages and the consequent high labor charges are a major problem in most areas. The farmers are discouraged from taking up manual sowing, weeding, and pesticide application because of this factor. Harvest costs are also exorbitant.

### **Transfer of technology**

The data presented here bring out a number of important points that have a bearing on the transfer of technology.

1. Being a traditional crop, groundnut benefits from the experience the farmers have already had in growing this crop.
2. Barring a few exceptional years when rainfall is normal resulting in a bumper crop and lower prices, groundnut is a remunerative crop.
3. In the Rabi season groundnut yields are assured.
4. The improved method is not expensive and even small farmers can adopt it. It revolves around using improved crop husbandary practices and optimum use of resources (fertilizers, labor) to obtain higher yields, better pod filling and higher oil content than the traditional method of cultivation.
5. High-yielding varieties with a yield potential of 4 to 6 t ha<sup>-1</sup> are now available. These varieties - e.g. ICGS 11, ICGS 44 - are more responsive to good management

than the traditional varieties. They have good pod characteristics and larger kernel size, and mature at about the same time as the traditional varieties (Table 16). These varieties also have wide geographic and seasonal adoptibility.

6. The improved method of groundnut cultivation relies on:
  - a. Good stand establishment by using good quality seed with 90-100% germination.
  - b. Good root development by using improved seedbed - raised beds and furrows, proper fertilizers and soil amendments - e.g. single super phosphate, zinc, iron, calcium - and proper water management.
  - c. Good root nodulation by proper seedbed preparation timely supply of sulphur and iron, irrigation and rhizobial inoculation. If these conditions are met the entire nitrogen requirement of the crop is supplied by Rhizobia. Application of rhizobial culture may not be necessary in fields with a history of groundnut cultivation.
  - d. Good canopy development is essential for high yields and can be ensured by uniform plant distribution, optimum fertilizer application, proper water management, and proper disease and pest control.
  - e. Reduced nitrogen application and reduced seeding rates to reduce excessive vegetative growth.
  - f. Harvesting at optimum maturity, i.e., when plants have 60% of the pods fully mature.



g. Keeping one's own seed by drying the pods in the shade to maintain the viability of seed.

Transfer of technology has proved to be fairly easy in the case of groundnut mainly because groundnut is a traditional and remunerative crop. Management-responsive, high-yielding varieties of the crop are adaptable to wide geographic and seasonal conditions. The improved method of cultivation is only slightly more expensive than the current method of cultivation and uses indigenous inputs that are known to farmers.

As a result of yield maximization demonstrations conducted in various states during the rainy season 1987, farmers in Maharashtra and Karnataka have adopted the ICRISAT method on a large scale.

## MHARASHTRA

### Area and Production

The state of Maharashtra traditionally has between 0.74 and 0.82 m ha under groundnut of which 0.1 to 0.2 m ha are under post-rainy cultivation. The average yield of post-rainy groundnut is 1460 kg ha<sup>-1</sup>. Due to severe droughts between 1985 and 1987, the area under post-rainy groundnut has declined considerably.

### Varieties

The common variety for summer groundnut is SB XI. This is a Spanish variety developed from a cross between Ah 4312 and Ah 4354 and was released in 1965. Pods are small and reticulated, and 1000 kernel weight ranges from 300 - 362 g depending upon the management. In coastal Maharashtra (Ratnagiri and Sindhudurg districts) JL 24 is also grown in the post-rainy season. Another Virginia runner variety, UF 70-103, was released in 1984 for post-rainy cultivation. This variety matures in 140-160 days and is high-yielding when optimum plant stand is achieved under good management. Two varieties from ICRISAT, ICGS 11 (released in 1986) and ICGS 44 (released in 1988), are becoming very popular. In some areas Karad 4-11 is also grown.

## **Season**

Almost all post-rainy season groundnut in Maharashtra is grown during summer (from February to June). There is a common belief among farmers that winters are too severe for groundnut, affecting germination and yield. However, in the adjoining states of Andhra Pradesh and Karnataka, winter (December) sowings are common. Temperature records from various places in Maharashtra have shown that the coldest period is during December and the first half of January; however, the temperature rarely goes below 10°C, the threshold temperature for groundnut. The groundnut crop that is grown in summer suffers from several disadvantages: (1) high summer temperatures of 37°C - 45°C during March-June increase water demand considerably, (2) because of water shortages after March, crops are often exposed to prolonged water deficits, (3) end season drought results in higher aflatoxin levels, (4) high temperatures during harvest (May-June) reduces the viability of seed, and (5) monsoon or pre-monsoon showers in June may cause germination of seed within pods. Changing of cultivation from summer to the Rabi season could alleviate many of these problems.

## **Soils**

Soils are mostly light to heavy Vertisols and are generally deficient in organic matter. The pH ranges from 8.06 to 8.80 and in some locations - e.g., at Mahud in Solapur district - can be very high. Most soils are deficient in

phosphorus. Extreme phosphorus deficiency was found in the Teosa area of Amraoti district. Zinc deficiency is widespread and in most areas, soils are also deficient in iron (Table 17). Potash deficiency is rare.

The water-holding capacity of soils ranges from poor to good depending upon soil texture. Soils with clay content of 60% or more tend to develop large cracks during April-June.

### **Pests and Diseases**

No major pests have been reported during the postrainy season. During the early 1980s leafminer was a serious pest. Thrips, especially *Scirtothrips dorsalis*, was a common pest during the seedling stage. Among diseases, bud necrosis disease (BND) is potentially dangerous. In the 1987 postrainy season it caused widespread destruction to the groundnut crop in parts of Kolhapur, Ratnagiri, Sangli, Satara and Solapur districts. In the 1980s BND was very destructive in Solapur and Parbhani districts, and affected not only groundnut but also the green gram, black gram and tomato crop.

### **Trials**

Five locations representing five major regions were chosen by the State for postrainy season trials (Table 18). The yield levels were low and ranged from 714 to 1575 kg ha<sup>-1</sup> in four districts. In the Satara district however, yields were high. In addition to the above trials, several trials were

conducted on farmers' fields by adopting a complete or partial package of practices based on ICRISAT recommendations. The latter included an increase in phosphorus application through use of single super phosphate (SSP), and the addition of gypsum and zinc. An experiment was conducted on the research farm of Konkan Agricultural University, Dapoli, to compare the ICRISAT technology with other packages of cultivation practices. The results from these trials are given. At the Taluka Seed Farm, Dhanora, Amraoti, winter sowing (November 15) was adopted. Because of the importance of this trial, detailed observations on temperature and growth parameters were recorded.

**Trial Location 1: Taluka Seed Farm, Dhanora, Amraoti District**

The seed farm is located besides the state highway from Yeotmal to Amraoti, about 60 km from Yeotmal and 28 km from Amraoti. This was an ideal location for a demonstration. The soil was a deep cotton black soil with clay content of 60%. The soil is deficient in phosphorus, zinc and iron, but rich in potash. We advocated incorporation of sand @ 20<sup>-1</sup> t ha to make the soil more porous.

The raised beds and furrows were prepared using a country plough on 12 November 1987 and the fertilizer was drilled on 15 November followed by sowing, herbicide application, and irrigation. The irrigation schedule was as follows:

15 November	-	Sowing
17 November	-	Rain 29 mm
18 November	-	Rain 59 mm
22 November	-	Very light irrigation (12.5 mm)
16 December	-	Light irrigation (25 mm)
30 December	-	Light irrigation (25 mm)
16 January	-	Full irrigation (50 mm)
26 January	-	Full irrigation (50 mm)
2 February	-	Full irrigation (50 mm)
13 February	-	Full irrigation (50 mm)
23 February	-	Full irrigation (50 mm)
9 March	-	Full irrigation (50 mm)
19 March	-	Full irrigation (50 mm)
28 March	-	Full irrigation (50 mm)
8 April	-	Light irrigation (25 mm) Harvest of SB XI
20 April	-	Light irrigation (25 mm) Harvest of ICGS 44

Plant growth: Seedling emergence was excellent (95-98%) for ICGS 44 and 100% for SB XI and was complete by 24 November, the 9th day after sowing. Fifty per cent of the plants had flowered 43 days after sowing. Peg formation, full pod development, and complete seed development were also normal. Plant height and leaf color were normal. The tap root and the rootlets were covered with nodules. Plant growth was much better in the ICRISAT method than in the State

method. Observations on growth parameters for SB XI are given below.

Sowing date	: 15 November
Emergence	: 24 November
Percent emergence	: 100%
Flowering (50%)	: 28 December (43 days)
Peg formation (50%)	: 3 January (49 days)
Full pod	: 17 January (63 days) .
Full seed	: 12 February (90 days)
Harvest maturity	: First week of April (135 days)
Final harvest	: 8 April

The temperature record for the cropping season is given in Table 19.

**Weed control:** Application of the herbicide Alachlor (Lasso) @ 3 litres ha<sup>-1</sup> gave excellent control of weeds including Cynodon. Alachlor was applied immediately after sowing, using a knapsack sprayer. In Alachlor-treated plots only one weeding sufficed while in the non-treated control plot 7 weedings plus 4 interculture operations were required. The cost of weed control in the herbicide-treated plot was Rs 660 ha<sup>-1</sup> compared to Rs 1885 ha<sup>-1</sup> for the control plot (Table 25).

**Yields:** Yields and ancillary data are given in Table 20. The ICRISAT variety ICGS 44 with the ICRISAT package of practices gave a dry pod yield of 4340 kg ha<sup>-1</sup>, while the State variety SB XI yielded 3300 kg ha<sup>-1</sup> under the same set

of conditions. Under the State package of practices, ICGS 44 gave a pod yield of 3090 kg ha<sup>-1</sup> and SB XI gave 2590 kg ha<sup>-1</sup>. There was a substantial increase in the oil content, kernel weight and pods of both SB XI and ICGS 44; pods were bigger and better-filled with the ICRISAT method than with the State method.

The ICRISAT and the State methods had two common operations. Both plots were sown by dibbling i.e., placement of seed by manual labor, and both were irrigated by using sprinklers. In the State plots the plant density was higher than in the ICRISAT method by 14% in ICGS 44 and by 24% in SB XI. But the yields were higher with the ICRISAT method than with the State method. Differences in terms of agronomic practices in the ICRISAT and State methods are shown in Table 21.

**Cost of cultivation:** With the ICRISAT method, the cost of cultivation was Rs.8996 ha<sup>-1</sup> compared to Rs 8564 ha<sup>-1</sup> with the State method (Table 22). The cost of cultivation includes land rent, electricity charges, supervision charges, rent for sprayers, etc. The labor costs are computed at the current daily wage rate of Rs.25 per bullock pair, Rs.10 per male laborer and Rs.7 per female laborer. The ICRISAT method was less labor-intensive than the State method (Table 23). Fertilizer cost for the ICRISAT method was substantially higher than for the State method (Table 24). Major cost reductions in the ICRISAT method were in weeding and interculture operations (Table 25).



**Trial location 2: Taluka Seed Farm, Basmat, Parbhani District**

The Taluka Seed Farm is located in the Parbhani district of Maharashtra. The area under post-rainy groundnut in this district ranges from 8000-14000 ha in different seasons. Due to assured supply of canal water in the 1987-88 season the area increased to about 20000 ha. The sowing is more or less synchronous, extending from the last week of January to the middle of February. The most common variety is SB XI.

The soils in this district are light to medium Vertisols with a pH of over 8. Although the soils are alkaline, they are not saline. They are deficient in phosphorus, zinc and iron but are rich in potash.

No major pest or disease problems have been reported except for heavy incidence of BND in the early 1980s.

The yields of post-rainy groundnut are generally low and average about 1350 kg ha<sup>-1</sup>. Most crops including groundnut, respond to phosphate application. Sunflower, safflower, sorghum and chickpea are the other main Rabi season crops in this area.

At Taluka Seed Farm, Basmat the soil is a light Vertisol, and the previous crop was pigeonpea. The soil depth is about 45 cm and soil pH was 8.3. The soil was deficient in phosphorus, zinc and iron, but rich in potash (Table 26). The first trial was sown on 20 January for

ICRISAT method and 1-February for the State method. The second trial was sown on 1 February for both treatments.

**Yields:** Yields at this seed farm were exceptionally high for the ICRISAT variety ICGS 11 and for the State variety SB XI under the ICRISAT package of practices. In the first trial ICGS 11 yielded 5260 kg ha<sup>-1</sup> while SB XI yielded 3440 kg ha<sup>-1</sup>. Using the State method, ICGS 11 yielded 4020 kg ha<sup>-1</sup> and SB XI yielded 3180 kg ha<sup>-1</sup> (Table 27).

In the second trial, under the ICRISAT method ICGS 11 yielded 4500 kg ha<sup>-1</sup> compared to 3480 kg ha<sup>-1</sup> for SB XI (Table 28). Under the State method ICGS 11 yielded 4030 kg ha<sup>-1</sup> and SB XI yielded 3010 kg ha<sup>-1</sup>.

#### Other Trials in Parbhani District

**Chikhalthana:** The trial at Chikhalthana was originally included in our set of trials. However, the well that supplied water dried up completely in April. Both varieties suffered from severe water stress. So after discussing with the Training and Visit System's staff, we decided to omit this trial. However, they were advised to record all observations to study the effect of drought. The results were very surprising and are given in Table 29.

**Malegaon:** This trial was conducted on a farmers' field as per ICRISAT's recommendation. The results were very encouraging and are given in Table 29.

**Agdad:** This trial was conducted on farmers' field near

Parbhani. The results are shown in Table 29.

Tadborgaon: This was another trial on farmers' field. The results are shown in Table 29.

#### **Trial Location 3: Taluka Seed Farm, Akluj, Solapur District**

As per the initial plans the Taluka Seed Farm at Mahud in Solapur district was chosen as a trial location. However, due to high soil salinity (pH 9.0 and E.C. 0.66), this location was replaced by Akluj in the same district.

The trial proved highly successful because it showed the yield advantage of ICGS 11 under heavy incidence of bud necrosis disease. SB XI, the State variety had disease incidence of over 50% compared to less than 20% in ICGS 11.

Yield from ICGS 11 with the ICRISAT method was 3110 kg ha<sup>-1</sup> compared to 690 kg ha<sup>-1</sup> for SB XI. When the State recommended package of practices was used, ICGS 11 gave a pod yield of 1600 kg ha<sup>-1</sup> compared to 560 kg ha<sup>-1</sup> for SB XI (Table 30). The cost of cultivation is given in Table 31.

#### **Trial Location 4: Taluka Seed Farm, Saidapur, Satara District**

This location was chosen to represent western Maharashtra. The land preparation was excellent. The trial was sown on 16 January 1988 and emergence was satisfactory. However, soon after emergence, there was heavy incidence of thrips and an epidemic of BND. Because the disease struck at the seedling stage, and the incidence was near 100% in all

varieties, there was no yield from the plants. This disease is transmitted by thrips. It would be interesting to study the epidemiology of the disease in this area and evolve suitable control measures. An immediate control measure that can be followed is to change the sowing date from January to February.

#### **Trial location 5: Mahafed Seed Farm, Pimpri, Dhule District**

This farm situated in Pimpri, Dhule district is representative of the area. The trial in the 1987 rainy season produced good results. The ICRISAT variety ICG (FDRS) 10 with the ICRISAT method gave  $1870 \text{ kg ha}^{-1}$  while the local variety SB XI with farmers, cultivation practices gave only  $550 \text{ kg ha}^{-1}$ .

In 1987-88 post-rainy season, the trial was sown on 12 January. The Seed Production Officer of Mahafed and the trial-in-charge attended to sowing. Seedling emergence was superb at almost 100% of the desired plant stand and the plant growth was normal. However, during the pod formation stage (from 21 March to end of April) there was complete stoppage of electricity supply and the crop nearly died. There was no other option but to abandon this trial.

**Diagnostic trial, Agricultural University Research Station,  
Dapoli, Ratnagiri District**

A small plot (20 sq m) experiment was conducted at Dapoli, Ratnagiri district, Maharashtra, using the variety JL 24.

The treatments were:

**Main treatments:**

- 1) Control
- 2) ICRISAT technology
- 3) Glyricidia 10 t/ha
- 4) 25 kg N + 50 kg P<sub>2</sub>O<sub>5</sub> through DAP
- 5) 25 kg N + 50 kg P<sub>2</sub>O<sub>5</sub> + 0.5 kg boron through boronated super phosphate + remaining P<sub>2</sub>O<sub>5</sub> through SSP.

**Sub treatments:**

Spacing 30 cm x 10 cm  
30 cm x 15 cm

The trial was sown on 22 December 1987 and harvested on 15 April 1988. The results showed that by using the ICRISAT method a yield of 5442 kg ha<sup>-1</sup> was obtained which was considerably higher than 3083 kg ha<sup>-1</sup> obtained from control plot.

There was a remarkable increase in phosphate and nitrogen uptake reflecting the considerable improvement in dry matter production, pod numbers, shelling percentage and 1000 kernel weight in the ICRISAT method (Table 32). There was no significant difference in yield between the two

spacings used (Table 32).

### **Partial Adoption of ICRISAT Technology - Trials in Farmers' Fields**

Several trials were conducted at Parbhani in farmers' fields. The trials were devised to identify suitable fertilizer doses and sources (carrier) of nutrients.

Results (Table 33) were as expected. As the soils were deficient in phosphorus, application of phosphorus was useful. However, changing the phosphorus source from diammonium phosphate to single superphosphate (SSP) alone increased the yields by  $120 \text{ kg ha}^{-1}$ . Addition of gypsum plus SSP increased the yield by about  $900 \text{ kg ha}^{-1}$ . Gypsum application was therefore extremely beneficial. Nitrogen was either not necessary or was required only in low dosages. The combination of SSP and gypsum substantially increased the total number of pods per plant and also the percentage of mature pods per plant.

## ANDHRA PRADESH

There were four trials in Andhra Pradesh, two in Kurnool district, one in Krishna district and another in Chittoor district.

### Kurnool District

This district has about 175000 ha under groundnut of which about 35000-40000 ha is under postrainy cultivation. Rainy season yields are generally low ( $470 \text{ kg ha}^{-1}$ ) and the postrainy yields are also low ( $1600 \text{ kg ha}^{-1}$ ). Postrainy groundnut is grown with high seed rates ranging from 150 to  $250 \text{ kg ha}^{-1}$  and receives high nitrogen and other fertilizer dosages. This coupled with excessive irrigation by flooding results in excessive vegetative growth to about 80-120 cm. However, crops are usually yellowish green, and individual plant may have 4-10 pods. Thus, to increase yields there is need to optimize the inputs to curtail excessive vegetative growth and better partitioning of photosynthates.

Soils (Table 34) in Kurnool district in general are deficient in phosphorus and iron but have adequate potash. Soils at Illuri have low manganese content. Soil pH is on the higher side and ranges from 7.62 to 8.3. Soils in Chittoor and Nizamabad district have low pH and high iron content, and are thus very suitable for groundnut cultivation. Severe phosphate deficiency was observed in Dhone and Gutti area of Anantapur district where plants were stunted and had chlorotic curled leaves with purple veins.

These symptoms slowly disappeared as the plants grew and their root system expanded. Potash and zinc deficiency was observed in some areas of Chittoor district.

Sowing starts from November and continues upto February depending on water availability.

Major pests in the postrainy season in this district are thrips Scirtothrips dorsalis and the leafminer Aproaerema modicella Dev. We have not seen Spodoptera litura as a major pest during the 1987-88 postrainy season; however, this insect can cause substantial damage to the crop. In parts of the adjoining districts of Guntur and Anantapur, Krishna, West Godavari, East Godavari, Nellore and Chittoor this pest has been destructive to many crops including groundnut during the early 1980's. Bud necrosis disease is common but not as alarming in Kurnool as in some other districts, notably Nalgonda. Plant density in excess of 350000 plants ha<sup>-1</sup> probably reduces the incidence of BND.

**Trial Location 1: State Seed Farm, Tangadencha, Kurnool District**

Tangadencha State Seed Farm which covers an area of about 500 ha, is located on the Kurnool-Guntur highway, 45 km from Kurnool and 9 km from Nandikotkur. This area is served by water from the Tungabhadra canal. Normal sowing date for the Rabi groundnut crop is from November-January; and cyclonic rains during November are common.



The soil at this location is light Vertisol and has good crumb structure (Table 34). Its water-holding capacity is good. The soil has a pH of 7.62. It is deficient in phosphorus and zinc, and moderately deficient in iron. Manganese content is very high. The trial was laid out and sown on 9 December 1987. The ICRISAT variety was ICGS 44 and the State variety was TMV 2. Looking at the soil data, we did not apply any nitrogen, but increased the dose of phosphorus through SSP to 31 kg ha<sup>-1</sup> and zinc, to 10 kg ha<sup>-1</sup>. In addition, two sprays of ferrous sulphate were given to both varieties under the ICRISAT method.

The growth of plants was normal. There was no excessive vegetative growth and the plant height at harvest was about 0.5 m. In the control plot where the State method was used 100 kg DAP ha<sup>-1</sup> was given; however, the foliage appeared yellowish green in contrast to the dark green leaves in the ICRISAT method and roots had fewer nodules than their counterparts in the ICRISAT method.

Plant density in the ICRISAT method and for the ICRISAT variety was 265000, compared to 315000 for the State variety. Under the State method, the ICRISAT variety had 227000 plants ha<sup>-1</sup> compared to 366000 plants ha<sup>-1</sup> for TMV 2 (Table 35).

Thrips ~~Scirtothrips~~ *dorsalis* was the major pest during November, January and February. Among diseases, low incidence of late leaf spot was observed. Rust was not

present.

**Yield and cost of cultivation:** Harvesting was done on 9 April 1988 in all plots although both varieties on raised beds matured 4 - 5 days earlier than in the State method. ICGS 44 under ICRISAT method gave 4366 kg ha<sup>-1</sup> and TMV 2, 3570 kg ha<sup>-1</sup> (Table 35). There was phenomenal increase in seed size and pod filling and this was reflected in increased kernel weight in the ICRISAT method. There was also considerable improvement in shelling percentage and oil content of ICGS 44 but not in TMV 2. It appears that ICGS 44 responded more to better management than TMV 2.

It is interesting to note the yield levels obtained at different plant densities. TMV 2 in ICRISAT method and with a plant density of 315000 ha<sup>-1</sup> yielded 3570 kg dry pods ha<sup>-1</sup> compared to 2260 kg ha<sup>-1</sup> in the State method with a plant density of 366000 ha<sup>-1</sup>. With plant density as low as 227000 ha<sup>-1</sup> in the State method, ICGS 44 yielded 3065 kg dry pods ha<sup>-1</sup>. It appears that a crop having plant density around 265000 ha<sup>-1</sup> is adequate to give high yields.

Cost of cultivation was Rs.10577.03 ha<sup>-1</sup> for ICGS 44 and Rs 10555.23 for TMV 2 in the ICRISAT method. This was marginally higher than the State method (Table 36). The higher cost in the ICRISAT method was due to application of zinc, higher manual labor required for sowing, and irrigation. This was however compensated by lower cost of cultivation resulting from non-application of urea, lower

seed rate used and considerably lower cost of weeding and interculture operations, plant protection and harvest.

It is interesting to study the differences in the cost of weeding and interculture. Although a herbicide was used in both methods - Alachlor a pre-emergence herbicide in the ICRISAT method and Basalin in the State method - much less weeding was required in ICRISAT method than in the State method. Better control of weeds by Alachlor in the initial stages of crop followed by their suppression by well - grown groundnut crop on raised beds reduced the weeding requirement. In the State method the gappiness in crop due to uneven distribution of seed and flooding of field resulted in excessive weed growth. Harvesting in the ICRISAT plot was not only easy but also less expensive.

A Farmers' Day organized by the State Department of Agriculture on 8 May 1988, was attended by about 400 farmers who appreciated ICRISAT's method of cultivation.

**Trial Location 2 - Project Demonstration and Development Farm, Yemmigannur, Kurnool District**

The trial was conducted on the Project Demonstration and Development Farm, Yemmigannur, 71 km from Kurnool on the Kurnool - Raichur road. Soils were light alfisols. Soil pH was 8.32; phosphate and potash were available in the soil in adequate quantity. The soils were moderately deficient in iron and zinc (Table 34). Groundnut is the major post-rainy season crop in this area.

The trial was sown on 5 December, 1987. Plant stand was near normal in ICGS 44 under both ICRISAT and State method but was grossly in excess for TMV 2 in the ICRISAT method and much lower in the State method (Table 37). Plant growth was vigorous in ICRISAT method. Application of the herbicide Alachlor @ 3 litres ha<sup>-1</sup> gave excellent weed control and reduced the cost of weeding and interculture operations to half that in the State method.

Thrips and leaf miner were noticed and were controlled by timely application of dimethoate @ 100 ml ha<sup>-1</sup>. Heliothis armigera and Spodoptera litura were also noticed but application of monocrotophos controlled these pests. One spray of dithane M-45 was given as prophylactic to control fungal foliar diseases. Application of pesticides was more in the State plot than in the ICRISAT plot.

**Yield and cost of cultivation:** We estimated the duration of crop of ICGS 44 to be about 135 days and for TMV 2 to be about 120 days after sowing. A Farmers' Day was fixed on 5 April 1988, 120 days after sowing anticipating the crop to be in optimum podding stage for demonstration to farmers. However, both varieties matured in less than 120 days and the crop on BBF matured 4 - 5 days earlier than the State method. In fact, both varieties were ready for harvest by the 4th week of March. This unexpected development resulted in delayed harvest causing about 20% pod loss in ICGS 44 on BBF.

The harvesting was done on 5 April. Notwithstanding the higher plant density of TMV 2 over ICGS 44 in the ICRISAT method, ICGS 44 gave much higher pod yield (2520 kg ha<sup>-1</sup>) than TMV 2 (1820 kg ha<sup>-1</sup>) (Table 37). The yields in the State method were lower for both varieties than in the ICRISAT method. ICGS 44 responded more to better management than TMV 2. This was clearly reflected in much higher kernel weight and shelling (%) in ICGS 44 under ICRISAT method than the State method. Similar effects were observed for TMV 2 but the magnitude of these differences were much lower than that for ICGS 44. There were only two differences in the two methods of cultivation: seed bed preparation, and FYM application.

Cost of cultivation (Table 38) was lower in the ICRISAT method than in the State method by about Rs 1100 ha<sup>-1</sup>. Lower costs in the ICRISAT method resulted from reduced cost of weed control, interculture, plant protection and harvest operations. It is interesting to note that in both methods of cultivation a weedicide, Basalin, was used; however, the number of weedings required in the ICRISAT method were only two compared to five in the State method. Rapid canopy coverage and vigorous plant growth on raised beds suppressed the weed population. Timely and optimum pesticide application reduced the cost of pesticide application in the ICRISAT method. Manual harvesting operations were easier in the ICRISAT method than in the State method.

In the State method, top dressing of ammonium sulphate (15 kg N) was given at the time of flowering. Apparently this did not contribute to increase yields. On the contrary it may have accelerated vegetative growth.

**Trial Location 3 : Project Development and Demonstration Farm, Mahadeomangalam, Chittoor District**

The trial was conducted at the Project Development and Demonstration Farm, Mahadeomangalam, 34 km from Chittoor. Soil at this farm was Alfisol with a pH of 6.42, which is ideal for groundnut. The soil was however deficient in phosphorus and potash, but rich in zinc and iron. Chittoor district has ideal soil pH and composition for groundnut (Table 34). This may be one of the reasons for extensive groundnut cultivation in the area both during the rainy and postrainy seasons.

The trial at Mahadeomangalam was sown on 16 December. Because of moisture stress, the germination was not good. The trial continued to suffer from water shortage and during March 1988 the crop wilted. These two serious faults were informed to the Director of Agriculture on 17 March 1988. Frequent electricity failures affected the functioning of electric motors thus affecting water supply during critical stages of the crop. We received data on yields and cost of cultivation from the trial in-charge. The latter was much lower than expected because labor charges were not included.

Yields are given in Table 39 and the cost of cultivation is given in Table 40. The data from this trial was included along with others that were considered unsuccessful.

**Trial Location 4: Project Development and Demonstration Farm, Garikapadu, Krishna District**

The trial at this location suffered because of low plant density. While ICGS 11 seed lot had low viability, it suffered further because its large seeds failed to pass through the seed bowl of the local seed drill. After changing several seed bowls, some improvement was noticed but the resultant plant stand was low in the State method. In the ICRISAT method where sowing was done manually, the plant density was lower by 30% than that required in ICGS 11 and by 17% in JL 24. Because of the large differences in plot density between and within different treatments, yields could not be compared. Yields are given in Table 41 and the cost of cultivation is given in Table 42.

## O R I S S A

Three locations were selected for postrainy groundnut demonstrations trials - Khurda and Sakhigopal in Puri district and Sukinda in Cuttack district. However, the trial at Sukinda was dropped because of lack of irrigation facility.

During 1985-86 postrainy groundnut occupied an area of about 19000 ha in Puri district with an average pod yield of 1650 kg ha<sup>-1</sup>, while in the Cuttack district it was grown on an area of about 80900 ha with an average pod yield of 1860 kg ha<sup>-1</sup>. Soils in Puri district are mostly loamy to sandy loam, and acidic. Sucking insects are the major pests affecting postrainy groundnut in Orissa. Rust and leaf spot are the major diseases affecting the crop.

### Location 1: Government Seed Farm Khurda, Puri District

The Government Seed Farm at Khurda has about 30 acres of cultivable land. The land that was earmarked for groundnut demonstration trials had to be replaced because it was in a low-lying area and was waterlogged by rains in November 1987. The alternate field available for the trial was only 0.25 ha resulting in small plots of about 0.06 ha per treatment.

**Soils:** At Khurda the soils were sandy loam and acidic. The pH was raised to about 7 by lime application. The available N was about 13 ppm; phosphorus, zinc and manganese were also



adequate (Table 43). However, potash was available in less than the desired level.

**Sowing dates, varieties and plant density:** The ICRISAT variety ICGS 44 and the State variety AK 12-24 following ICRISAT practice (treatments 1 and 2) were sown on 3 December 1987 on broad beds at a spacing of 30 x 10 cm. Before sowing, peat inoculant of Rhizobium strain NC 92 suspended in water was applied to the furrow. The same genotypes following State practice (treatments 3 and 4) were sown on 4 Dec 1987. No Rhizobium inoculation was followed in the State practice. Significant response to Rhizobium inoculation was observed in nodulation 48 days after sowing. Groundnut variety AK 12-24 was early maturing compared to ICGS 44. It was harvested 115 DAS in the ICRISAT plot and 117 DAS in the State practice plot. ICGS 44 was harvested 124 DAS in the State plot and 125 DAS in the ICRISAT plot. At harvest the average plant density over all treatments was 280000 plants ha<sup>-1</sup> (Table 44).

**Pests and diseases:** Spodoptera was the major pest on groundnut at Khurda. Groundnut variety AK 12-24 appeared to attract more Spodoptera than ICGS 44. Thrips also caused some damage to groundnut foliage. A total of 7 sprays of insecticides were used for controlling insect pests. No serious disease affected the groundnut crop. The late leafspot disease affected the crop during later growth stages but caused little damage.

**Yields:** ICGS 44 with ICRISAT practice gave the highest yield of 4450 kg dry pods ha<sup>-1</sup> while AK 12-24 with ICRISAT practice yielded 3020 kg dry pods ha<sup>-1</sup>. Similarly, ICGS 44 gave higher yield (3560 kg dry pods ha<sup>-1</sup>) with State practice when compared to AK 12-24 (2600 kg ha<sup>-1</sup>). Thus it is clear that ICGS 44 was better than AK 12-24 and ICRISAT practice was better than State practice with both groundnut varieties. However, AK 12-24 was better than ICGS 44 in terms of haulm yield (Table 44).

**Cost of cultivation:** The cost of cultivation for ICGS 44 or AK 12-24 with ICRISAT practice was Rs.19246.40 ha<sup>-1</sup> and Rs.15525.10 per ha<sup>-1</sup> with State practice (Table 45).

**Location 2: Government Seed Farm, Sakhigopal, Puri District**

**Soils:** The soil at the Government Seed Farm, Sakhigopal was sandy loam and acidic (pH ranged between 5.15 to 6.96). The soil had available nitrogen ranging between 10.1 and 13.6 ppm, adequate P and Mn, but was deficient in potassium (K content 13-28 ppm) and zinc (0.54 to 2.1 ppm Zn) (Table 43).

**Sowing date, varieties and plant density:** The treatment 1 (ICGS 44 with ICRISAT practice) and treatment 2 (AK 12-24 with ICRISAT practice) were sown on broad beds on 8 December 1987, and treatments 3 and 4 (ICGS 44 and AK 12-24 with State practice) were sown on 9 December 1987. Liquid suspension of Rhizobium culture NC 92 was used to inoculate seed furrows before sowing the seed in ICRISAT practice

treatments 1 and 2. At harvest the plant density ranged between 242000 to 255000 plants ha<sup>-1</sup> (Table 46). The plant population was low particularly in ICGS 44 plot with ICRISAT practice (Table 46) as no gap filling was attempted after seed germination and emergence. Another reason for low plant population was that the beds were trampled in the early growth stages causing soil compaction. There was significant response to *Rhizobium* inoculation in nodulation of both genotypes 42 days after sowing (Table 46). AK 12-24 was harvested 116 days after sowing while ICGS 44 took 122 days for maturity.

**Pests and diseases:** *Spodoptera* was the major pest on groundnut. Timely insecticide sprays (a total of 4 sprays) controlled the pest. Thrips *S.dorsalis* and leafminer *A.modicella* were the other pests that caused some foliar damage. Early leaf spot, late leaf spot and rust disease were also observed but caused little damage.

**Yields:** Groundnut variety ICGS 44 with ICRISAT practice yielded 3670 kg dry pods ha<sup>-1</sup>, while AK 12-24 kg gave 2500 kg ha<sup>-1</sup>. With State practice ICGS 44 yielded 2570 kg dry pods ha<sup>-1</sup> and AK 12-24 yielded 2170 kg ha<sup>-1</sup>. Haulm yields were 10800 kg ha<sup>-1</sup> from ICGS 44 with ICRISAT practice, 10900 kg ha<sup>-1</sup> from AK 12-24 with ICRISAT practice, 10800 kg ha<sup>-1</sup> from ICGS 44 with State practice, and 10550 kg ha<sup>-1</sup> from AK 12-24 with State practice (Table 46).

**Cost of cultivation:** The cost of cultivation of groundnut with ICRISAT practice was Rs. 11619.3 ha<sup>-1</sup> and Rs 7510 ha<sup>-1</sup> with State practice (Table 47).

## G U J A R A T

### Area and Production

The State of Gujarat has about 2.06 million ha under groundnut with a production of about 1.57 million t averaging to about 762 kg dry pods ha<sup>-1</sup>. In the postrainy season the state has about 0.13 million ha under groundnut and produces about 0.18 million t of the crop. The mean yield for postrainy season groundnut is about 1.38 t ha<sup>-1</sup>. (Agriculture situation in India, 1983-84). The main postrainy season groundnut - growing areas in Gujarat are Bhavnagar, Junagadh, Kheda and Kutch districts. However, during the 1987-88 season, area under the crop was greatly reduced due to drought.

In Kheda district, the postrainy season groundnut was introduced only in 1980. Groundnut is sown during the third or fourth week of January. The taluka-wise area and productivity of groundnut for the period 1983 to 1987 is given in Table 48.

### Soils

The soils of Kheda district are sandy, or light to heavy Vertisols. Sandy loam soils predominate in Anand, Petlad, Nadiad, Borsad and parts of Thasra and Khambat talukas. The pH of the soil ranges from 7.0 to 8.8 and the electrical conductivity generally ranges from 0.33 to 0.63 mmhos/cm. The organic carbon content ranges from 0.40 to

1.05%. The status of nitrogen content is low to intermediate, phosphorus content is medium, and potassium content is medium to high. The taluka-wise details of chemical and physical properties are given in Table 49.

#### **Climate**

December and January are the coldest months. Occasionally, there are cold spells when the minimum temperature can drop below 10<sup>o</sup> C. Therefore, sowing is normally done between the second week of January and the second week of February, when temperatures are congenial for seed emergence and crop growth.

#### **Varieties**

The most common varieties for post-rainy cultivation are J 11 and GG 2; both varieties are small-seeded and have Spanish bunch growth habit. J 11 was developed from a cross Ah 4218 X Ah 4354 and was released in 1964 for the Gujarat state. GG 2 was developed from a cross J 11 X EC 16659 and was released in 1983 for post-rainy cultivation in the Saurashtra region. The 1000 kernel weight of both GG 2 and J 11 is around 367 g. In 1988, the ICRISAT variety, ICGS 44 was released in Gujarat for post-rainy cultivation and is becoming popular.

#### **Pests and Diseases**

During the post-rainy season the incidence of insect pests is low. Among diseases, plants affected with bud necrosis disease (BND) were observed.

**Trials:** Two locations - Nadiad and Boriavi - were chosen in Kheda district by the officials of the Department of Agriculture.

**Trial Location 1:** Taluka Seed Farm, Nadiad, Kheda District

The soils at the Taluka Seed Farm, Nadiad are medium deep Vertisols with high clay content and high pH (8.48). These soils are also prone to waterlogging. The sowing in all the treatments was done on 18 January 1988. The ICRISAT plots were irrigated on 18 January while the State plots received a presowing irrigation on 8 January 1988.

**Yields:** The dry pod yield of ICRISAT variety with ICRISAT package was  $1901 \text{ kg ha}^{-1}$ . The same variety in the State recommended package of practices gave  $1151 \text{ kg ha}^{-1}$ . The State variety GG 2 produced  $1846 \text{ kg ha}^{-1}$  in the ICRISAT method and  $1279 \text{ kg ha}^{-1}$  in the State method (Table 50). Plant density in all plots but particularly in the State method was very low. Therefore, yield comparison between the ICRISAT and the State method was not possible, and the trial was considered unsuccessful.

**Cost of cultivation:** The cost of cultivation for the ICRISAT package was  $\text{Rs.}6568 \text{ ha}^{-1}$  as compared to  $\text{Rs.}5705 \text{ ha}^{-1}$  for the State package (Table 51).

**Location 2: Taluka Seed Multiplication Farm, Boriavi, Kheda District**

The trial was sown on 17 January 1988 and was irrigated on the same day. The soil at this location was loamy Alfisol with high silt content. The soil after each irrigation formed a compact mass that affected root development. The pH was also very high (9.08). Irrigation water was saline with high EC (1.08 mmhos/cm) and high residual sodium carbonate (2.6 mg/litre). The plants remained dwarf with severely chlorotic foliage even after sprays of ferrous sulphate and reduced irrigation. Because of this combination of factors, the plants remained stunted and had yellow foliage.

Under both the packages, the plant population of ICRISAT variety ICGS 44 was higher than the State variety GG 2. The low plant population in GG 2 resulted from poor quality seed used for sowing. Suboptimum plant density and salinity problems made yield comparisons unrealistic. Therefore, the trial was considered unsuccessful.

**Yields:** The ICRISAT variety (ICGS 44) in the ICRISAT method yielded 1775 pods kg ha<sup>-1</sup> and the State variety GG 2 under the same method produced 710 kg pods ha<sup>-1</sup>. The low yield of GG 2 was due to poor plant stand. The ICRISAT variety in the State method gave 1718 pods kg ha<sup>-1</sup> as compared to 915 kg ha<sup>-1</sup> for the State variety (Table 52). Because of the large variation in plant density, yield comparisons were not possible.

Cost of cultivation: The cost of cultivation for the ICRISAT package was Rs.6279<sup>-1</sup> as compared to Rs.5382<sup>-1</sup> for the State package of practices (Table 53).



## TAMIL NADU

In Tamil Nadu, three locations were selected for the post-rainy season groundnut yield maximisation trials - Musaravakkam and Putlur in Chengalput district and Neyveli in South Arcot district. The trial at Neyveli was in collaboration with the Tamil Nadu Co-operative Oilseeds Growers' Federation (TANCOF). One more trial was conducted in the farmers' field in Rettanai village under the close supervision of Mr. K. Sibi of the TANCOF.

Post-rainy season groundnut is grown in 42500 ha<sup>-1</sup> in Chengalput district with an average pod yield of 2.0 t ha<sup>-1</sup>. In South Arcot District the area under groundnut is around 58000 ha with an average pod yield of 1.6 t ha<sup>-1</sup>. Soils in both the districts are sandy loam Alfisols. Soils around Neyveli are acidic and lateritic. The crops are normally sown with the North-East monsoon during November-December. The varieties TMV 2, TMV 7 and JL 24 are commonly grown. Two varieties CO 1 and CO 2 released by the Tamil Nadu Agricultural University are also grown in some pockets. The seed is dibbled manually using a "punch and drop" technique. Small holes are punched in the soil with a small spade at intervals of 10 cm along the seeding row and one seed is dropped in each of these holes almost simultaneously by skilled laborers.

Among insect pests, thrips - Scirtothrips dorsalis, the leaf miner - Aproaerema modicella, and the leaf eating caterpillars - Spodoptera litura and Heliothis armigera and among diseases, late leaf spot and rust pose problems in both South Arcot and Chengalput districts.

**Location 1. State Seed Multiplication Farm, Musaravakkam, Chengalput District**

The State Seed Multiplication Farm, Musaravakkam, in Chengalput district, which had a trial in the 1987 rainy season, was selected for the post-rainy season trial. The soil was light sandy Alfisol which dries up rapidly as water percolates into the lower soil strata. Frequent application of water is therefore necessary to raise crops in these soils. Field plots selected for the trial had a pH of 8.21 and N, P, K, Zn, and Fe contents of 7.52, 9.68, 56.5, 0.71 and 4.60 ppm respectively. The soil data indicated deficiency in phosphorus, potash and zinc.

The ICRISAT variety ICGS 44 and the State variety CO 2 were grown in comparison as per the ICRISAT and State methods (Table 54).

**Land preparation, sowing and crop growth:** The soils were tilled to obtain good tilth. Fertilizers were broadcast and incorporated into the soils during the last preparatory tillage operation. In ICRISAT plots broadbeds were prepared and seeding furrows were opened by a tractor drawn 'Broadbed-and-furrow maker' supplied by the TANCOP, Neyveli.

The seeds were placed in the seeding furrows at intervals of 10 cm and then covered. In State plots seeds were dibbled using the "punch and drop" technique.

In all the plots, irrigation was given after sowing to wet 12-15 cm of the top soil, followed by a light irrigation 4 days after sowing to ensure good seedling emergence. Subsequent irrigations were given as required by the crop in different plots. Plots in ICRISAT method were irrigated by sprinklers while those in the State method were irrigated by flooding check-basin method.

The seedlings emerged after 6 days and grew well throughout the season. During the middle of the season the plant density of both varieties were optimal at about 29-32 plants m<sup>-1</sup> in both the ICRISAT and State methods.

**Weeds, insect pests and diseases:** No weedicide was used in any of the plots because Cyperus rotundatus which was the predominant weed species cannot be controlled with herbicides. Three-to-five weedings were required to control weeds depending upon the weed intensity in different plots.

Among insect pests, H. armigera, thrips S. dorsalis and leaf miner Aproearema modicella were important. The variety CO 2 was more susceptible to these pests, particularly to H. armigera, than ICGS 44 in both ICRISAT and State plots. Among diseases, late leaf spot and rust posed problems. Pests and diseases were controlled by using 4-10 sprays of

pesticides in different plots. For the control of H. armigera in CO 2, the nuclear polyhydrosis virus was also used. Among insecticides--chloropyrifos, endosulfan, monocrotophos and decamethrin (Decis), and among fungicides--Dithane M-45 and Bavistin, were used.

**Harvesting and yields:** Both ICGS 44 and CO 2 matured in about 101 days in both ICRISAT and State plots. They were harvested on the same day in both the plots. The plant density at harvest, yield and other parameters recorded for the trial are given in Table 55. The variety ICGS 44 performed marginally better than CO 2 in both methods (Table 55). Between methods, the State method proved better than the ICRISAT method in yield. However, kernel weight and shelling in both varieties were higher in the ICRISAT method than in the State method.

**Cost of cultivation:** The cost of cultivation for the trial are given in Table 56. The ICRISAT method incurred costs of about Rs.1000 ha<sup>-1</sup> more than the State method for variety CO 2 and about Rs.1500 ha<sup>-1</sup> for variety ICGS 44. The cost of interculturing and weeding for ICGS 44 was substantially higher than CO 2 in the ICRISAT method. The reasons for this difference are not known. The less susceptibilty of ICGS 44 to insect pests was reflected in substantially lower cost in plant protection than CO 2 in both methods. The reasons for differences in harvest cost of CO 2 and ICGS 44 in ICRISAT method are not known.

**LOCATION 2: State Seed Multiplication Farm, Putlur, Chengalput District**

A trial was conducted at the State Seed Multiplication Farm, Putlur, which is 5 Km from the taluka headquarters, Tiruvullur. The field plots selected for the trial were loamy Alfisols with a pH of 7.05; and N, P, K, Zn, and Fe contents of 8.75, 19.75, 67, 2.1 and 15.6 ppm respectively. The soil was deficient only in potash.

The ICRISAT variety ICGS 44 and the State variety CO 2 were grown in comparison as per the ICRISAT and State methods (Table 57).

**Land preparation, sowing and crop growth:** The soil was tilled to obtain good tilth and fertilizers were broadcast and incorporated into the soil during land preparation. In the ICRISAT plots broadbeds were prepared and seeding furrows were opened by a tractor drawn 'Broadbed-and-furrow maker'. The seeds were sown in the seeding furrows at intervals of 10 cm. In the State plots, the seeds were dibbled using the "punch and drop" technique.

In all the plots, irrigation was given just after sowing to wet the top 12-15 cm of the soil. This was followed by a light irrigation 4 days after sowing to ensure good seedling emergence. Subsequent irrigations were given as required by the crop in different plots. For irrigation, sprinklers were used in ICRISAT plots and a check-basin method used in the State plots.

The crops emerged after 6 days and grew well throughout the season. During the middle of the season the plant density of both ICGS 44 and CO 2 were optimal at about 27 plants/m<sup>2</sup> in ICRISAT plots. The plant density in State plots was about 280 plants/m<sup>2</sup>, much below the optimum of 33 plants/m<sup>2</sup> for both varieties.

**Weeds, insect pests and diseases:** No weedicide was used in any of the plots because of the prevalence of Cyperus rotundatus. Three hand-weedings were required to control weeds in each plot.

Among insect pests, thrips -S. dorsalis, Heliothis armigera and Spodoptera litura, and among diseases, the late leaf spot posed problems. The insecticide and fungicide were mixed together and applied twice to the crop.

**Harvest and Yields:** Both ICGS 44 and CO 2 matured in about 102 days. The maturity in ICRISAT plots was little earlier and consequently, the harvesting was started with these plots. The plant population at harvest, yield and other parameters are given in Table 58. Both ICGS 44 and CO 2 had 2.68-2.91 lakh plants ha<sup>-1</sup>. ICGS 44 yielded more than CO 2 in both methods. Further, the produce from ICRISAT method was superior in kernel weight, pods per plant and shelling quality. The oil content of the produce did not show much advantage with either method. Surprisingly, the oil content of CO 2 was much lower (38% in ICRISAT method than in the

state method (46.8%). However, this appears to be an aberration and was disregarded for calculating averages.

**Cost of cultivation:** The cost of cultivation (Table 59) was slightly more in the State method than in the ICRISAT method.

**Performance of ICGS 21:** Besides ICGS 44, the ICRISAT variety ICGS 21 was given to the State Seed Multiplication Farm, Putlur. This variety was also planted under ICRISAT and State methods but not considered for comparison in the trial as it is not a released variety. Further, it had plant population well below the optimum at 1.9 lakh ha<sup>-1</sup> in the ICRISAT plot and 2.4 lakh ha<sup>-1</sup> in the State plot. However, in spite of low population this variety yielded 3.06 t ha<sup>-1</sup> from the ICRISAT plot and 3.18 t ha<sup>-1</sup> in the State plot. In addition ICGS 21 was superior in kernel weight (> 580 g/1000 kernels) compared to ICGS 44 and CO 2. ICGS 21 was also less susceptible to late leaf spot disease than ICGS 44 and CO 2. If this observation is confirmed, ICGS 21 could be a suitable variety for both rainy and post-rainy seasons.

**Location 3: TANCOP Seed Multiplication Farm, Neyveli, South Arcot District**

The Seed Multiplication Farm of the Tamil Nadu Co-operative Oilseeds Growers' Federation (TANCOP), Neyveli, which also conducted a trial in 1987 rainy season, was selected for a trial in the 1987-88 post-rainy season. Soils in the field plots selected for the trial were lateritic Alfisols with pH of 4.80 and N, P, K, Zn, and Fe contents of 3.5, 37.5, 116.0, 0.7 and 7.9 ppm respectively indicating moderate zinc deficiency, and a pH unsuitable for groundnut.

The ICRISAT variety ICGS 44 and the State variety CO 2 were grown in comparison as per the ICRISAT and State package of practices given in Table 60.

**Land preparation, sowing and crop growth:** The soils were tilled to obtain good tilth. Fertilizers were broadcast and incorporated into the soils during the last preparatory tillage operation. In the ICRISAT plots broadbeds with seeding furrows were prepared by a tractor drawn 'Broadbed and - furrow maker' developed at the farm. The seeds were sown in the seeding furrows at intervals of 10 cm. In the State plots seeds were dibbled using the "punch and drop" technique.

Soon after sowing in ICRISAT plots, heavy rain (<50 mm) was received in the night. This caused delay in sowing in the State plots by 5 days. The furrows in the BBF in the ICRISAT plots helped to drain off the excess water very efficiently



from the fields. The rain ensured good germination in ICRISAT plots. However, in the State plots irrigation just after sowing was required to saturate the top 12-15 cm of the soil. A light irrigation was given after 7 days to ensure good seedling emergence. Subsequent irrigations were given as per the requirement of the crops in different plots. For irrigation, a sprinkler was used in ICRISAT plots and a check-basin method used in the State plots.

The crops emerged after 6 days and grew well throughout the season. During the middle of the season the plant stand of all the three varieties in both the ICRISAT and State plots was in the range of 27-30 plant m<sup>2</sup>.

**Weeds, insect pests and diseases:** No weedicide was used in any of the plots because herbicides are not effective against the weed Cyperus rotundatus. Two interculturings and two hand weedings were given in the ICRISAT plots and only two hand-weedings were given in the State plots. In the ICRISAT plots interculturing with a tractor was possible and most convenient.

Among insect pests, thrips S. dorsalis, Heliothis armigera and Spodoptera litura, and among diseases leafspot and rust were observed. These pests and diseases were controlled by sprays of insecticides and fungicides. In most applications the insecticide and fungicide were mixed together as the crop required protection from both pests and diseases. ICGS 44 in both methods received one more

application of the pesticide as it was unknowingly harvested late due to wrong judgement of its maturity. Further, ICGS 44 was drenched with the fungicide Benlate in the ICRISAT plot to prevent pod rotting due to Sclerotium which started with the irrigation of the matured crop.

**Harvesting and yields:** Both ICGS 44 and CO 2 matured in about 101-108 days. Unfortunately, the farm manager delayed the harvesting of ICGS 44 under the impression that it matures in 120 days, and gave one irrigation in ICRISAT plot when the crop was fully matured. This resulted in some yield loss due to "Sclerotium rot". Since this was detected in time, harvesting was done before further pod loss in the soil.

The plant population at harvest, yield and other parameters are given in Table 61. In spite of Sclerotium damage ICGS 44 performed better or was at least on par with CO 2 in both ICRISAT and State treatments. Both varieties under ICRISAT method proved better in terms of yield, kernel weight, shelling and oil content than under the State method. The shelling was 8-9% higher in the produce from ICRISAT plots than from State plots.

**Cost of cultivation:** The cost of cultivation (Table 62) for the ICRISAT method was higher by over Rs. 1200 ha<sup>-1</sup> than the State method. The higher cost incurred in the ICRISAT method was due to the use of more fertilizers and frequent weeding operations. The higher cost of cultivation for ICGS 44 in

both methods was due to an additional application of pesticide and for Benlate application in the soil of the ICRISAT plot. This could have been avoided if maturity in ICGS 44 was carefully monitored.

#### Extra Trial at TANCOP, Neyveli

Besides the above trial, a parallel trial was conducted by TANCOP to compare the ICRISAT variety ICGS 44 with the State variety CO 1. The trial planted on 25-26 December 1987 was conducted in a similar manner to the ICGS 44 - CO 2 yield maximisation trial. Here ICGS 44 yielded  $2.45 \text{ t ha}^{-1}$  in the ICRISAT plot and  $2.25 \text{ t ha}^{-1}$  in the State plot, whereas CO 1 yielded  $2.35 \text{ t ha}^{-1}$  in ICRISAT plot and  $2.0 \text{ t ha}^{-1}$  in the State plot.

#### Trial in the Farmer's Field

TANCOP conducted another similar trial in one of the farmer's field in Rettanai village in Tindivanam taluka, South Arcot district. The TANCOP provided ICGS 44 seed to the farmer. The farmer raised ICGS 44 and CO 1 varieties each on 0.2 ha plots under ICRISAT method, and the variety CO 1 on 0.2 ha under State method.

The cost of cultivation and the yield data furnished by the farmer are given in Table 63. ICGS 44 yielded  $2.4 \text{ t ha}^{-1}$  as against  $2.02 \text{ t ha}^{-1}$  of CO 1 under ICRISAT method. Further, the yield of CO 1 variety in the ICRISAT method more than that in the State method. This increase in yield was at an extra cost of  $\text{Rs.}665 \text{ ha}^{-1}$  for ICGS 44 over CO 1.

## K A R N A T A K A

In Karnataka, three locations were selected for post-rainy season groundnut yield maximisation trials - Guladhalli and Turkondona in Raichur district, and R K Shala in Bangalore district. The trial at Turkondona was in collaboration with the Karnataka Co-operative Oilseeds Growers' Federation (KOF). An almost similar trial was conducted by the KOF in a farmer's field.

### Soils, Yields and Varieties

Post-rainy season groundnut is normally grown in 30500 ha in Raichur district with an average pod yield of 1.6 t ha<sup>-1</sup>, and over 2600 ha in Bangalore district with an average pod yield of 3.24 t ha<sup>-1</sup>. Soils in these districts are Alfisols; some are lateritic and form a hard crust with receding moisture. Around Bangalore soils are acidic. In Raichur district, groundnut is normally grown under canal irrigation whereas in Bangalore district, the crop is grown under well irrigation. The varieties TMV 2 and JL 24 are commonly grown in both the districts. In addition, two other varieties - S 206 and KRG 1 - are grown in Raichur district. The sowing is done mostly by using a local seed drill. However, in some areas dibbling is also practiced in a flat seed bed or on both sides of the slope with ridges of 60-75 cm. Irrigation is either by flooding or through furrows.

## Pests and Diseases

Among insect pests, the leaf miner Aproaerema modicella and the leaf-eating caterpillar Spodoptera litura and among diseases, late leaf spot affects the groundnut crop in Raichur district. In Bangalore district the incidence of pest and disease is usually low; thrips and jassids sometimes affect the crop.

Location 1: State Seed Multiplication Farm, Guladhalli, Raichur District

The State Seed Multiplication Farm, Guladhalli, Raichur district, which was selected for the rainy season trial, was also selected for the trial in the postrainy season. This farm is in the heart of postrainy season groundnut area of Raichur district. The field plots selected for the trial were lateritic Alfisols. The soils had a pH of 8.29 and N, P, K, Zn, and Fe contents of 10.50, 25.19, 261.50; 1.35 and 5.48 ppm respectively. No potash fertilizer was recommended in the ICRISAT package as the soils were rich in potash. The soils were however deficient in iron.

The ICRISAT variety ICGS 44 and the State variety S 206 were grown in comparison as per the ICRISAT and State package of practices (Table 64).

Land preparation, sowing and crop growth: The soils were tilled to obtain good tilth. In ICRISAT plots, broadbeds were formed by a bullock-drawn wheeled tool carrier, the "tropicultor". The fertilizers were drilled on the beds

using a 4-tined 'gorru' (local seed drill). The seeds were dropped in the furrows at intervals of 10 cm and then covered. The State plots were made into ridges and furrows of 60 cm width after incorporating fertilizers into the soil during the last operation of harrowing. The seeds were dibbled on both sides of the ridges half way on the slopes.

After sowing, herbicide was applied in ICRISAT plots while no herbicide was used in the State plots. This was followed by first irrigating all the plots to wet the top 12-15 cm of the soil. A light irrigation was given after 4 days to ensure good crop emergence. Subsequent irrigations were done as required by the crop in different plots. For irrigation, a sprinkler was used in ICRISAT plots and a check-basin method (flooding) used in State plots.

The crops emerged after 7 days and grew very well. During the middle of the season the plant density of both ICGS 44 and S 206 was in the range of 27-30 plants  $m^2$  in both the ICRISAT and State plots.

**Weeds, insect pests and diseases:** The pre-emergence herbicide Alachlor, applied in ICRISAT plots was not beneficial as it could not control Cyperus rotundatus, the predominant weed. To control weeds, four interculturings and four hand-weedings were given in ICRISAT plots while two interculturings and one hand-weeding were given in State plots. Interculturing in ICRISAT plots was most convenient and effected by using a tropicultor.

Among insect pests, thrips *Scirtothrips dorsalis* was a major pest. It were controlled by using two sprays of dimethoate. A minor infestation of *S. litura* was controlled by one spray of monocrotophos. One more spray, a mixture of dimethoate and dithane M 45 was given later in the season in ICRISAT plots as a prophylactic against thrips and late leaf spot disease.

**Harvesting and yields:** Both the varieties matured by 130 days in ICRISAT plots. However, the harvesting of crops in ICRISAT plots were delayed by about a week by the farm manager to organise a Farmers' Day. Irrigation given to ICRISAT plots after crop maturity resulted in some yield loss due to *Sclerotium* rot, particularly in S 206. In spite of this, ICGS 44 in ICRISAT plot yielded more (3.6 t ha<sup>-1</sup>) than in the State plot (2.93 t ha<sup>-1</sup>). However, S 206 which suffered more by rotting yielded somewhat lower in the ICRISAT plot than in the State plot (Table 65). The quality of groundnut produced in the ICRISAT plots was much better than that produced in the State plots as reflected in higher shelling, oil content and kernel weight.

**Cost of cultivation:** The cost of cultivation under ICRISAT and State methods are given in Table 66. The ICRISAT method required over Rs. 1500 ha<sup>-1</sup> more than the State method. The higher cost of ICRISAT method was largely due to the use of a herbicide, which proved futile. The application of pesticide later in the season could also have been avoided

without any adverse effect on yield.

Interestingly, the cost of four interculturings and four weeding in ICRISAT plots was at par with the cost of two interculturings and one weeding in State plots. This was because the interculturing using a tropicultor was most convenient and effective in ICRISAT plots; as a consequence, the requirement of manual labor for weeding operations was low.

**Location 2: Seed Multiplication Farm, Turkondona, Raichur District**

A trial was conducted at the Seed Multiplication Farm of the Karnataka Cooperative Oilseeds Growers' Federation (KOF), Turkondona, which is 4 km from the village of Gilesgur on the Raichur-Kurnool road. This farm is in the midst of large stretches of post-rainy season groundnut. The field plots selected for the trial at this farm were lateritic Alfisols. They had a pH of 6.63 and N, P, K, Zn, and Fe contents of 12.46, 39.50, 163, 2.44 and 4.70 ppm respectively indicating high soil fertility and ideal soil pH for groundnut.

The ICRISAT variety ICGS 44 and the state variety KRG 1 were grown in comparison as per the ICRISAT and State package of practices given in Table 67.

**Land preparation, sowing and crop growth:** The soils were tilled to obtain good tilth. Fertilizers were incorporated into the soil during the last operation of harrowing. The broadbeds in ICRISAT plots were formed using a bullock-drawn



wheeled tractors. The seeding furrows were opened by a 4-tined seed drill and seeds were dropped in these furrows at intervals of at 10 cm and then covered. In State plots the seeds were sown using a local 3-tined seed drill.

After sowing, the ICRISAT plots were sprayed with herbicide while no herbicide was applied in the State plots. This was followed by irrigating in all the plots to wet the top 12-15 cm of the soil. A light irrigation was given after 4 days to ensure good crop emergence. Subsequent irrigations were given as required by the crop in different plots. For irrigation, a sprinkler was used in ICRISAT plots and a check-basin method used in State plots.

The seedlings emerged after 7 days and grew very well. During the middle of the season the plant density of both the varieties in the ICRISAT plots was 31-37 plants m<sup>2</sup>. However, it was suboptimal in State plots, and was about 18-19 plants/m<sup>2</sup>.

**Weeds, insect pests and diseases:** The preemergence herbicide Alachlor applied in ICRISAT plots could not control the weed Cyperus rotundatus. Three hand weedings were required to control weeds in all the plots.

Among insects, incidence of thrips, jassids and leaf miner were recorded. The incidence of bud necrosis disease (BND) was high. The variety KRG 1 was more susceptible to BND than ICGS 44. On 40th day of the crop, BND incidence was about 3% in the KRG 1 trials and 1% in the ICGS 44

trials in both the ICRISAT and State plots. On the 70th day, it increased in KRG 1 to 40% in ICRISAT plot and 60% in the State plot, whereas in ICGS 44 it increased to only 15% in ICRISAT plot and 30% in the State plot. The late leaf spot disease too was observed. Application of two sprays of dimethoate and one spray of monocrotophos+dithane M 45 controlled pests and diseases. An application of methyl parathion (Folidol) dust was given to control *H. armigera*.

**Harvesting and yields:** The crops in ICRISAT plots matured 3 days earlier than the crops in the State plots. There was no difference in maturity between KRG 1 and ICGS 44 in both the methods. Crops were harvested at the same time by the farm manager to coincide with the Farmers' Day. Both ICGS 44 and KRG 1 recorded higher yields under ICRISAT method than under the State method (Table 68). ICGS 44 proved far superior in yield attributes than the State variety KRG 1.

Further, the groundnut produced from the ICRISAT plots proved distinctly superior in kernel weight and pods per plant than from the State plots. ICGS 44 from the ICRISAT plot also proved superior in oil content and KRG 1 recorded higher shelling percentage.

**Cost of cultivation:** The cost of cultivation under ICRISAT and State methods are given in Table 69. The ICRISAT method required about Rs 1500 ha<sup>-1</sup> more than the State method. The additional expenditure in the ICRISAT method was largely due to herbicide use, which served no purpose, and one more

application of pesticide which could have also been avoided without any crop loss.

**Location 3: - State Seed Multiplication Farm, R K Shala, Bangalore District**

The State Seed Multiplication Farm, Rama Krishnapuram Shala, Anekal taluk Bangalore district, at which the 1987 rainy season trial was conducted, was also selected for the post-rainy trial 1987-88. The field plots selected for the trial were lateritic Alfisols with a pH of 6.84 and N, P, K, Zn, and Fe contents of 7.85, 6.37, 76, 0.98 and 7.1 ppm respectively indicating phosphorus and potash deficiency. The pH was ideal for groundnut, and zinc and iron were adequate.

The ICRISAT variety ICGS 11 and the State variety TMV 2 were grown in comparison as per the ICRISAT and State package of practices given in Table 70.

**Land preparation, sowing and crop growth:** The soils were tilled to obtain good tilth. Fertilizers were broadcast and incorporated into the soil during the last operation of harrowing. In ICRISAT plots, broadbeds were formed using a bullock-drawn ridger plough. The seeding furrows on the beds were opened by a 4-tined seed drill and seeds were dropped in these furrows at intervals of 10 cm. In the State plots furrows were opened on the flat land and seeds were dibbled.

After sowing, the ICRISAT plots were sprayed with herbicide while no herbicide was sprayed on State plots.

This was followed by first irrigating all the plots to wet the top 12-15 cm of soil. A light irrigation was given 6 days after sowing to ensure good crop emergence. Subsequent irrigations were as required by the crop in different plots. Sprinkler irrigation was used in the ICRISAT plots and a check-basin (flooding) method used in the State plots.

The seedlings emerged after 10 days. The initial growth, particularly of ICGS 11, was slow because of low temperatures ( $< 15^{\circ}$  C) experienced during that period. Worried about slow growth, the farm manager applied some DAP and even urea to ICGS 11 in both the plots. However, as temperatures warmed up from the second week of January, the crops grew well. During the middle of the season, the plant density of ICGS 11 was 18 plants/m<sup>2</sup> in the ICRISAT plot and 25 plants/m<sup>2</sup> in the State plot. TMV 2 had 27 plants/m<sup>2</sup> in both the ICRISAT and State plots.

**Weeds, insect pests and diseases:** The pre-emergence herbicide Alachlor, applied in the ICRISAT plots could not control weeds Cyperus rotundatus, and Cynodon dactylon which affected the crop at this location. Three hand-weedings were required to control weeds in all the plots.

Among insects, thrips and leaf miner posed problems but they were controlled effectively by using dimethoate and monocrotophos. Among diseases, late leaf spot affected the crop and was controlled by using dithane M 45. Of the 4 pesticide applications, 2 were in the form of a mixture of

fungicide and insecticide.

**Harvest and yields:** Both ICGS 11 and TMV 2 matured by 126-128 days. However, maturity in the ICRISAT plots was about 2 days earlier than in the State plots. The plant density at harvest, yield and other parameters are given in Table 71.

In spite of low population, ICGS 11 yielded more than TMV 2 both in ICRISAT and State plots. Further, its yield was more from the State plot than from the ICRISAT plot. This was because it had more plant population in the former than the latter. The performance of TMV 2 was also better in the ICRISAT plot. In terms of other attributes - number of pods per plant, kernel weight, and oil content, - the produce from the ICRISAT plots was superior to that from State plots. In shelling too, the ICRISAT method proved superior to the State method for ICGS 11, but not for TMV 2.

**Cost of cultivation:** The cost of cultivation of the trial is given in Table 72. The cost of cultivation at this trial was higher because lime was added to the soils to improve the soil pH. This was, however, superfluous. The ICRISAT method required about Rs.2000 ha<sup>-1</sup> more than the State method largely due to the use of more lime and the application of herbicide in ICRISAT plots.

### Trial in Farmer's Field at Kalmala, Raichur District

The Karnataka Co-operative Oilseeds Growers' Federation conducted one more trial in farmer's field in Kalmala village of Manvi taluka in Raichur District to test the effectiveness of ICRISAT method against the State method by using the local variety, S 206. The plot size was 0.2 ha. In ICRISAT plots, broadbeds were formed by opening furrows using a 'Baliram plough'. Final shaping of beds was done with a spade by using manual labor. Details of the package of practices followed by the farmer are given in Table 73. The yield and cost of cultivation for the trial are given in Table 74.

The variety S 206 under ICRISAT method yielded 3.80 t ha<sup>-1</sup> as against 1.78 t ha<sup>-1</sup> under the State method. The shelling percentage was higher in produce from the ICRISAT plot (76%) than from the State plot (73.5%). The cost of cultivation under ICRISAT method was also lower (Rs.5492.50 ha<sup>-1</sup>) than under the State method (Rs.5612.50 ha<sup>-1</sup>). This was because the weeding and harvesting costs were relatively lower in the ICRISAT method than in the State method.

Table 1. Groundnut varieties used in yield maximization trials, post-rainy season, 1987-88.

State/Location	Cultivation practice			
	ICRISAT		State	
	ICRISAT variety	State variety	ICRISAT variety	State variety
<b>Andhra Pradesh</b>				
Yemmigannur	ICGS 44	TMV 2	ICGS 44	TMV 2
Tangadencha	ICGS 44	TMV 2	ICGS 44	TMV 2
Mahadeomangalam*	ICGS 11	TMV 2	ICGS 11	TMV 2
Garikapadu*	ICGS 11	JL 24	ICGS 11	JL 24
<b>Karnataka</b>				
Guladhalli	ICGS 44	S 206	ICGS 44	S 206
Turkondona	ICGS 44	KRG 1	ICGS 44	KRG 1
R J Shala	ICGS 11	TMV 2	ICGS 11	TMV 2
<b>Tamil Nadu</b>				
Putlur	ICGS 44	CO 2	ICGS 44	CO 2
Neyveli	ICGS 44	CO 2	ICGS 44	CO 2
Musaravakkam	ICGS 44	CO 2	ICGS 44	CO 2
<b>Orissa</b>				
Khurda	ICGS 44	AK 12-24	ICGS 44	AK 12-24
Sakhigopal	ICGS 44	AK 12-24	ICGS 44	AK 12-24
<b>Maharashtra</b>				
Amraoti	ICGS 44	SB XI	ICGS 44	SB XI
Basmat I	ICGS 11	SB XI	ICGS 11	SB XI
Basmat II	ICGS 11	SB XI	ICGS 11	SB XI
Akluj	ICGS 11	SB XI	ICGS 11	SB XI
Saidapur*	ICGS 11	SB XI	ICGS 11	SB XI
Dhule*	ICGS 11	SB XI	ICGS 11	SB XI
<b>Gujarat</b>				
Nadiad*	ICGS 11	G 2	ICGS 11	G 2
Boriavi*	ICGS 44	G 2	ICGS 44	G 2

\* Trials not successful

**Table 2. Sowing dates for ICRISAT and State plots at different locations, post-rainy season, 1987-88.**

State/Location	Cultivation practice			
	ICRISAT		State	
	ICRISAT variety	State variety	ICRISAT variety	State variety
<b>Andhra Pradesh</b>				
Yemmigannur	5 Dec 87	5 Dec 87	5 Dec 87	5 Dec 87
Tangadencha	9 Dec 87	9 Dec 87	9 Dec 87	9 Dec 87
<b>Karnataka</b>				
Guladhalli	11 Dec 87	11 Dec 87	11 Dec 87	11 Dec 87
Turkondona	26 Dec 87	26 Dec 87	26 Dec 87	26 Dec 87
R K Shala	25 Dec 87	25 Dec 87	25 Dec 87	25 Dec 87
<b>Tamil Nadu</b>				
Putlur	15 Dec 87	15 Dec 87	15 Dec 87	15 Dec 87
Neyveli	3 Dec 87	3 Dec 87	8 Dec 87	8 Dec 87
Musaravakkam	16 Dec 87	16 Dec 87	15 Dec 87	15 Dec 87
<b>Orissa</b>				
Khurda	3 Dec 87	3 Dec 87	4 Dec 87	4 Dec 87
Sakhigopal	8 Dec 87	8 Dec 87	9 Dec 87	9 Dec 87
<b>Maharashtra</b>				
Amraoti	15 Nov 87	15 Nov 87	15 Nov 87	15 Nov 87
Basmat I	20 Jan 88	20 Jan 88	29 Jan 88	29 Jan 88
Basmat II	30 Jan 88	30 Jan 88	31 Jan 88	31 Jan 88
Akluj	16 Jan 88	16 Jan 88	16 Jan 88	16 Jan 88



Table 3. Seeding rates (kg ha<sup>-1</sup>) used in groundnut trials at various locations, post-rainy season, 1987-88.

State/Location	Cultivation practice			
	ICRISAT		State	
	ICRISAT variety	State variety	ICRISAT variety	State variety
<b>Andhra Pradesh</b>				
Yemmigannur	132	150	150	150
Tangadencha	132	132	150	140
<b>Karnataka</b>				
Guladhalli	140	140	150	150
Turkondona	125	125	150	150
R K Shala	140	140	150	150
<b>Tamil Nadu</b>				
Puttur	124	124	125	120
Neyveli	125	125	125	125
Musaravakkam	127	127	125	125
<b>Orissa</b>				
Phurda	140	140	125	125
Sakhigopal	150	122	133	129
<b>Maharashtra</b>				
Anracti	120	120	150	150
Basmat I	107	98	120	120
Basmat II	107	98	120	120
Akluj	140	140	150	150
Average	129.2	127.2	137.3	136.0

Table 4. Plant densities (1000 ha<sup>-1</sup>) in the ICRISAT and State plots post-rainy season, 1987-88.

State/Location	Cultivation practice			
	ICRISAT		State	
	ICRISAT variety	State variety	ICRISAT variety	State variety
<b>Andhra Pradesh</b>				
Yemmigannur	274.8	349.8	321.8	233.3
Tangadencha	264.8	315.4	226.6	365.6
<b>Karnataka</b>				
Guladhalli	275.8	252.6	231.4	251.6
Turkondona	372.8	317.8	187.6	197.2
R K Shala	189.4	247.6	231.8	256.2
<b>Tamil Nadu</b>				
Putlur	268.0	268.8	270.8	290.8
Neyveli	317.0	291.0	291.0	272.0
Musaravakkam	246.6	268.0	254.6	318.0
<b>Orissa</b>				
Khurda	289.0	272.2	278.0	281.8
Sakhigopal	240.0	255.0	252.0	252.0
<b>Maharashtra</b>				
Amraoti	256.6	267.6	293.2	331.2
Basmat I	299.0	297.7	163.0	197.0
Basmat II	206.3	209.7	219.0	242.0
Akluj	-	-	-	-
<b>Average</b>	<b>269.23</b>	<b>277.93</b>	<b>247.75</b>	<b>268.36</b>

-1

**Table 5. Location-wise dry pod yield (t ha<sup>-1</sup>) of groundnut, post-rainy season, 1987-88.**

State/Location	Cultivation practice			
	ICRISAT		State	
	ICRISAT variety	State variety	ICRISAT variety	State variety
<b>Andhra Pradesh</b>				
Yemmigannur	2.52	1.82	1.98	1.54
Tangadencha	4.37	3.57	3.07	2.26
<b>Karnataka</b>				
Guladhalli	3.60	2.27	2.93	2.51
Turkondona	4.77	2.37	1.99	0.97
R K Shala	3.85	3.35	4.31	3.17
<b>Tamil Nadu</b>				
Putlur	3.56	2.48	3.60	2.37
Neyveli	3.16	2.93	2.26	2.30
Musaravakkam	2.28	2.04	2.35	2.27
<b>Orissa</b>				
Khurda	4.45	3.02	3.56	2.60
Sakhigopal	3.67	2.50	2.57	2.17
<b>Maharashtra</b>				
Amraoti	4.34	3.30	3.09	2.59
Basmat I	5.26	3.44	4.02	3.18
Basmat II	4.50	3.48	4.03	3.01
Akluj	3.11	0.69	1.60	0.56
<b>Average</b>	<b>3.82</b>	<b>2.66</b>	<b>2.95</b>	<b>2.25</b>

**Table 5A. Two way table of comparison of average dry pod yield of groundnut between varieties and cultivation practices.**

Variety	Cultivation practice		Percentage increase	Average	Percentage increase
	ICRISAT	State			
ICRISAT	3817	2954	29.2	3385	37.9
State	2661	2250	18.3	2455	
% Increase	43.4	31.3	.		
Average	3240	2600			
% increase	24.6				

**Table 6. Shelling percentage of groundnut harvested in trial plots, post-rainy season, 1987-88.**

State/Location	Cultivation practice			
	ICRISAT		State	
	ICRISAT variety	State variety	ICRISAT variety	State variety
<b>Andhra Pradesh</b>				
Yemmigannur	72	75	69	74
Tangadencha	76	73	68	73
<b>Karnataka</b>				
Guladhalli	75	74	65	70
Turkondona	73	66	67	68
R K Shala	75	74	68	75
<b>Tamil Nadu</b>				
Putlur	74	77	72	76
Neyveli	82	80	73	72
Musaravakkam	76	72	75	67
<b>Orissa</b>				
Rhurda	78	80	77	77
Sakhigopal	76	77	75	74
<b>Maharashtra</b>				
Amraoti	78	78	78	76
Basmat I	69	64	66	64
Basmat II	74	66	71	69
Akluj	69	63	66	67
Average	74.78	72.80	70.70	71.60
a. Average for the cultivation practice		73.79%		71.15%
Increase over the State method		3.71%		
b. Average for the varieties				
ICRISAT		72.74%		
State		72.20%		
c. Increase in ICRISAT method over the State method				
ICRISAT variety		5.77%		
State variety		1.67%		

**Table 7. 1000 kernel weight (g) of groundnut harvested in trial plots, post-rainy season, 1987-88.**

State/Location	Cultivation practice			
	ICRISAT		State	
	ICRISAT variety	State variety	ICRISAT variety	State variety
<b>Andhra Pradesh</b>				
Yemmigannur	531	373	449	383
Tangadencha	551	396	313	300
<b>Karnataka</b>				
Guladhalli	499	352	322	353
Turkondona	509	393	424	334
R K Shala	500	402	459	392
<b>Tamil Nadu</b>				
Puttur	527	449	491	402
Neyveli	571	520	463	426
Musaravakkam	527	485	463	433
<b>Orissa</b>				
Khurda	461	369	473	339
Sakhigopal	448	349	450	363
<b>Maharashtra</b>				
Amraoti	603	362	558	327
Basmat I	462	383	458	366
Basmat II				
Akluj	534	356	450	311
<b>Average</b>	<b>517</b>	<b>399</b>	<b>444</b>	<b>364</b>

**Table 7A. Two way comparison of 1000 kernel weight between two methods of cultivation and two varieties, postrainy season, 1987-88.**

Variety	Cultivation practice		Percentage difference	Average	Percentage difference
	ICRISAT	State			
ICRISAT	517.15	444.08	16.45	480.61	26.01
State	399.15	363.77	9.72	381.40	
Percentage difference	29.56	22.08			
Average	458.15	403.92			
Percentage difference	13.42				

**Table 8. Oil content (%) of groundnut harvested in trial plots, post-rainy season, 1987-88.**

State/Location	Cultivation practice			
	ICRISAT		State	
	ICRISAT variety	State variety	ICRISAT variety	State variety
<b>Andhra Pradesh</b>				
Yemmigannur	44.4	44.0	45.2	42.4
Tangadencha	49.2	47.4	45.5	47.8
<b>Karnataka</b>				
Guladhalli	45.2	47.6	45.4	45.1
Turkondona	48.4	46.5	48.9	46.1
R K Shala	49.1	46.8	48.6	46.8
<b>Tamil Nadu</b>				
Putlur	47.0	38.0*	46.8	46.5
Neyveli	45.3	48.8	44.7	47.5
Musaravakkam	46.4	47.1	47.5	48.2
<b>Orissa</b>				
Khurda	45.0	45.1	44.4	44.6
Sakhigopal	48.3	47.3	47.1	46.7
<b>Maharashtra</b>				
Amraoti	45.2	44.8	42.8	44.0
Basmat I	47.6	47.5	47.0	48.2
Basmat II	-	-	-	-
Akluj	50.6	47.7	52.2	49.0
<b>Average</b>				
	47.05	46.72	46.62	46.38
<b>Average for cultivation practice</b>				
	46.89		46.50	

\* - Not considered for calculating the average



Table 9. Dry haulm weight (t ha<sup>-1</sup>) of groundnut harvested in trial plots, post-rainy season, 1987-88.

State/Location	Cultivation practice			
	ICRISAT		State	
	ICRISAT variety	State variety	ICRISAT variety	State variety
<b>Andhra Pradesh</b>				
Yemmigannur	2.62	1.73	3.45	1.70
Tangadencha	3.96	4.02	3.16	3.46
<b>Karnataka</b>				
Guladhalli	3.98	4.40	4.48	4.90
Turkondona	5.08	4.70	2.64	2.46*
R K Shala	2.92	4.98	4.32	4.76
<b>Tamil Nadu</b>				
Puttur	3.75	2.78	4.33	4.98
Neyveli	2.85	4.55	4.37	3.15
Muṣaravakkam	3.57	3.79	5.36	5.62
<b>Orissa</b>				
Khurda	3.94	3.24	3.06	2.95
Sakhigopal	4.26	2.78	3.93	2.69
<b>Maharashtra</b>				
Amraoti	6.20	3.14	4.60	4.40
Basmat I	4.93	4.90	3.70	6.00
Basmat II	3.74	3.60	3.60	6.10
Akluj	6.00	2.62*	3.21	1.82*
<b>Average</b>	<b>4.13</b>	<b>3.66</b>	<b>3.87</b>	<b>3.93</b>

\* High incidence of bud necrosis disease.

Table 10. Cost of cultivation (Rs ha<sup>-1</sup>) of groundnut in trial plots, post-rainy season, 1987-88.

State/Location	Cultivation practice			
	ICRISAT		State	
	ICRISAT variety	State variety	ICRISAT variety	State variety
<b>Andhra Pradesh</b>				
Yemmigannur	8256.9	8256.9	9335.6	9335.6
Tangadencha	10577.0	10555.2	9317.5	9407.5
<b>Karnataka</b>				
Guladhalli	11475.0	11515.0	9870.0	9870.0
Turkondona	7447.5	7447.5	5987.5	5987.5
R K Shala	13565.0	12570.0	11465.0	10502.5
<b>Tamil Nadu</b>				
Puttur	8294.1	8464.7	8920.2	8920.2
Neyveli	9236.2	8755.5	8109.8	7519.2
Musaravakkam	9533.7	9578.0	8037.5	8607.2
<b>Orissa</b>				
Khurda*	19296.5	19296.5	15525.1	15525.1
Sakhigopal	11619.3	11619.3	7510.3	7510.3
<b>Maharashtra</b>				
Amraoti	8996.0	8996.0	8564.2	8564.2
Basmat I	7660.0	6447.0	5923.0	5104.0
Basmat II	7660.0	6447.0	5923.0	5104.0
Akluj	9975.0	9975.0	9325.0	9325.0
<b>Average</b>	<b>9561.3</b>	<b>9420.1</b>	<b>8329.9</b>	<b>8135.2</b>
<b>Average for the cultivation practice</b>	<b>9490.7</b>		<b>8232.6</b>	

\* Not considered in the average

Note: The table has been compiled from the data provided by farm managers.

**Table 11. Duration of ICRISAT and State groundnut varieties at different locations, post-rainy season, 1987-88.**

State/Location	Cultivation practice			
	ICRISAT		State	
	ICRISAT variety	State variety	ICRISAT variety	State variety
<b>Andhra Pradesh</b>				
Yemmigannur	121 (112)	121 (112)	121	121
Tangadencha	120 (115)	120 (115)	120	120
<b>Karnataka</b>				
Guladhalli	129 (114)	129 (114)	130 (123)	130 (123)
Turkondona	114	114	117	117
R K Shala	126	126	128	128
<b>Tamil Nadu</b>				
Putlur	102	102	102	102
Neyveli	108	101	105	100
Musaravakkam	101	101	102	102
<b>Orissa</b>				
Khurda*	124	114	123	116
Sakhigopal	122	115	121	121
<b>Maharashtra</b>				
Amraoti	162	145	162	145
Basmat I	127	127	124	124
Basmat II	117	117	116	116
Akluj	106	106	106	106
<b>Average</b>	<b>119.92</b>	<b>117.00</b>	<b>119.78</b>	<b>117.71</b>

( ) Figures in parentheses describe harvest maturity in days

**Table 12. Summary of groundnut trial data, postrainy season, 1987-88.**

Yield parameters	Cultivation practice			
	ICRISAT		State	
	ICRISAT variety	State variety	ICRISAT variety	State variety
Dry pod wt (t ha <sup>-1</sup> )	3.817	2.661	2.954	2.250
Range	2.28-5.26	0.69-3.57	1.60-4.31	0.56-3.11
Shelling (%)	74.78	72.80	70.70	71.60
Range	69.0-82.0	63.0-80.0	65.0-78.0	64.0-76.0
1000 Kernel wt (g)	517.15	399.15	444.08	363.77
Range	448.603	349-520	313-558	300-433
Oil content (%)	47.05	46.72	46.62	46.38
Range	44.4-50.6	44.0-48.8	42.8-52.2	42.4-49.0
Haulm wt (t ha <sup>-1</sup> )	4.13	3.66	3.87	3.93
Range	2.62-6.20	1.73-4.98	2.64-5.36	1.70-6.10
Cost of cultivation	9585	9303	8343	8145
Range (Rs ha <sup>-1</sup> )	7447-13765	7447-12770	5923-11665	5104-106
Income (Rs ha <sup>-1</sup> )				
Pods	26880	18550	20510	16170
Haulm	2065	1830	1935	1965
Total	28945	20380	22445	18135
Profit (Rs ha <sup>-1</sup> )	19629	11307	14194	10116

Note: Income from pods has been calculated @ Rs.7000 t<sup>-1</sup> and from haulms @ Rs 500 t<sup>-1</sup>.

**Table 13. Comparison of yield parameters of improved and common varieties under the State method of cultivation, post-rainy season, 1987-88.**

Yield parameters	Varieties		Percentage difference
	Improved	Common	
Pod yield kg ha <sup>-1</sup>	2954	2250	31.28
Shelling (%)	70.7	71.6	1.27
1000 kernel wt (g)	444.08	363.77	22.07
Oil content (%)	46.62	46.38	0.52
Cost of cultivation Rs ha <sup>-1</sup>	8343.00	8145.00	2.43

**Table 14. Comparison of the ICRISAT and the State method of cultivation in relation to yield parameters, post-rainy season, 1987-88.**

Yield parameters	Method of cultivation		Percentage difference
	ICRISAT	State	
Pod yield kg ha <sup>-1</sup>	3240	2600	24.61
Shelling (%)	73.79	71.15	3.71
1000 kernel wt (g)	458.15	403.92	13.42
Oil content (%)	46.89	46.50	0.84
Cost of cultivation Rs ha <sup>-1</sup>	9444	8244	14.56

**Table 15. Comparison of ICRISAT method and ICRISAT variety with the State method and State variety in relation to yield parameters, post-rainy season, 1987-88.**

Yield parameters	ICRISAT method + ICRISAT variety	State method + State variety	Percentage difference
Pod yield kg ha <sup>-1</sup>	3817	2250	69.64
Shelling (%)	74.78	71.60	4.44
1000 kernel wt (g)	517.15	363.77	42.16
Oil content	47.05	46.38	1.44
Cost of cultivation Rs. ha <sup>-1</sup>	9585.00	8145.00	

Table 16. Yields of groundnut under different fertilizers in farmers fields, Parbhani district, Maharashtra, post-rainy season, 1987-88.

Number of farmers	Nutrient kg ha-1				Fertilizers used				Yield kg ha-1	Cost ha-1 Rs	Cost benefit ratio*
	N	P	K	Ca	N	P	K	Ca			
1	92	80	120	-	Urea	SSP	MOP	-	3100	1296	1:16.7
1	18	114	10	-	Urea	SSP	MOP	-	3100	900	1:24.1
4	17.5 (12-23)	72 (64-80)	-	282.5 (80-400)	Urea	SSP	-	Gypsum	3050	698	1:30.7
14	0	70.28 (48-80)	-	367.1 (300-500)	-	SSP	-	Gypsum	2900	547	1:37.1
3	9	57-66 (55-63)	-	-	-	DAP+SSP	-	-	2800	590	1:33.2
3	-	(57.33) (48-60)	-	150	-	SSP	-	Gypsum	2216	460	1:33.7
3	11.66 (10-12)	74.66 (64-80)	-	-	Urea	SSP	-	-	2130	595	1:25.0
3	35.4 (20-45)	49.0 (46-55)	-	-	Urea + DAP	-	-	-	2175	600	1:25.3
8	-	54.5	-	-	-	SSP	-	-	1978	400	1:34.6
11	21.3 (14-22)	46.78 (36-55)	-	-	-	DAP	-	-	2009	418	1:33.6
1	25	25	-	-	20:20 mixture	-	-	-	2000	390	1:35.8
2	46	48	-	-	Urea	SSP	-	-	1775	510	1:21.8
District average					-	-	-	-	1334	-	-

Urea = Rs 2200 t-1, N = 46%

DAP = Rs 3800 t-1, N = 18%, P 46%, P2O5 46%

SSP = Rs 1000 t-1, P2O5 = 14%

Muriate of Potash = Rs 1400 t-1, K = 47%

Gypsum = Rs 400 t-1

20:20 mixture = Rs 3120 t-1

DAP = Diammonium phosphate

SSP = Single superphosphate

MCP = Muriate of Potash

20:22 mixture = 20 N + 20 P

\* Income from pods was calculated @ Rs. 7000 t-1



**Table 16A. Results from trials in farmers' fields, Dhule district, Maharashtra, post-rainy season, 1987-88.**

No. of trials	Method of cultivation	Pod yield kg ha <sup>-1</sup>	Shelling (%)	Cost of cultivation
31	ICRISAT	2030	69.10	5512
31	State	1560	65.86	4912

Table 17. Characteristics of the selected fields in Maharashtra.

Location	District	Soil type	pH	EC µmhos	P	K	Zn	Po	Mn
DDM									
Ahmednagar	Ahmednagar	Light Vertisol	8.06	0.15	7.50	426	1.00	12.7	20.75
Pimpri	Dhule	Heavy Vertisol	8.62	0.46	7.75	234	0.74	4.0	8.8
Dhule	Dhule	Light Vertisol	8.80	0.38	9.25	163	0.50	5.7	10.0
Sarve	Dhule	Light Vertisol	8.66	0.23	11.00	496	0.56	3.6	9.8
Rhirpur	Dhule	Light Vertisol	8.64	0.21	10.75	250	1.24	3.0	12.54
Sindheda	Dhule	Light Vertisol	8.74	0.24	6.00	269	0.60	4.6	9.50
Velhane	Dhule	Light Vertisol	8.31	0.14	7.50	144	0.84	3.4	11.54
Mahud	Solapur	Alkaline Vr. soil	8.52	0.66	10.00	419	0.70	4.6	7.00
Wai	Satara	Heavy Vertisol	8.08	0.17	25.50	288	0.80	4.8	11.0
Saidanur	Satara	Heavy Vertisol	8.10	0.42	9.50	123	0.94	5.2	8.74
Niwali	Parbhani	Medium Vertisol	8.20	0.74	10.50	270	1.04	5.6	25.5
Parbhani	Parbhani	Light Vertisol	8.33	0.21	5.00	317	0.64	3.6	7.5
Teosa	Amranti	Heavy Vertisol	8.29	0.18	1.25	200	0.80	7.2	9.8
Critical level					10.0	100	1.0	10.0	-

**Table 18. Locations of groundnut yield maximization trials in Maharashtra, post-rainy season, 1987-88.**

Location	District	Region represented	Area (ha)	Production (t)	Average yield (kg ha <sup>-1</sup> )
Dhanora	Amraoti	Vidarbha	2800	2000	714
Basmat	Parbhani	Marathwada	9000	12100	1344
Akluj	Solapur	Central	19800	31200	1575
Pimpri	Dhule	Northern	14100	17000	1205
Saidapur	Satara	Western	3600	9300	2583

**Table 19. Daily minimum and maximum temperature from sowing (15 Nov 1987) till pod development (9 Feb 1988), Taluka Seed Farm, Dhanora, Amraoti district, Maharashtra, post-rainy season, 1987-88.**

Month	Day	Temperature o C		Remarks	
		Minimum	Maximum		
15 November	15	26	26	Sowing	
	16	25	28		
	17	25	29		
	18	24	30		
	19	23	27		
	20	24	28		
	21	22	28		
	22	22	29		
	23	21	28		
	24	20	28		
	25	21	27		Emergence
	26	22	27		
	27	22	27		
28	21	28			
29	27	27			
30	20	27			
December	1	20	27		
	2	20	28		
	3	19	27		
	4	19	27		
	5	20	27		
	6	20	27		
	7	18	27		
	8	18	26		
	9	18	26		
	10	20	27		
	11	23	30		
	12	23	27		
	13	20	23		
	14	18	24		
	15	16	23		
	16	17	24		
17	15	22			
18	15	22			
19	15	22			
20	15	24			
21	15	24			
22	15	24			
23	16	25			
24	17	25			
25	17	24	Flowering		
26	18	25			
27	17	24			
28	16	24			
29	16	23			

Month	Day	Temperature o C		Remarks
		Minimum	Maximum	
December	30	16	23	
	31	16	24	
January	1	16	25	
	2	16	25	
	3	16	25	Peg formation
	4	17	27	
	5	17	28	
	6	15	26	
	7	19	26	
	8	19	28	
	9	19	28	
	10	20	28	
	11	20	28	Pod formation
	12	20	27	
	13	20	29	
	14	22	29	
	15	22	28	
	16	21	30	
	17	22	30	Full pod size
	18	22	30	
	19	22	30	
	20	20	28	
	21	21	31	
	22	22	31	
	23	22	31	Seed formation
	24	22	31	
	25	22	31	
	26	21	30	
	27	20	30	
	28	20	30	
	29	21	30	
	30	21	32	
	31	22	31	
February	1	21	31	
	2	21	31	Full seed size
	3	21	29	
	4	19	30	
	5	18	30	
	6	18	31	
	7	19	31	
	8	19	30	
	9	20	31	

**Table 20. Plant density, yield and ancillary data from groundnut trials at Taluka Seed Farm, Dhanera, Amraoti district, Maharashtra, post-rainy season, 1987-88.**

Trial details and yields	Method of cultivation			
	ICRISAT		State	
	ICGS 44	SB XI	ICGS 44	SB XI
Sowing date	15 Nov	15 Nov	15 Nov	15 Nov
Sowing method	Dibbling	Dibbling	Dibbling	Dibbling
Irrigation	Sprinkler	Sprinkler	Sprinkler	Sprinkler
Emergence	25 Nov	23 Nov	25 Nov	23 Nov
Percentage emergence	95	98	88	100
Plant density	256600	267600	293200	331200
Harvest date	23 April	10 April	23 April	10 April
-1				
Yield kg ha				
Dry pods	4340	3300	3090	2590
Haulms	6200	4600	3140	4400
Shelling (%)	78	78	78	76
1000 kernel wt (g)	603	362	558	327
Oil (%)	45.2	44.8	42.8	44.0
Cost of cultivation (Rs ha <sup>-1</sup> )	8996	8996	8664	8564

**Table 21. Comparison of operations/inputs used in the ICRISAT method and the State method, yields and cost of cultivation, Taluka Seed Farm, Dhanora, Amraoti district, Maharashtra, post-rainy season, 1987-88.**

Operations/ Inputs	ICRISAT method	State method
Tillage	Ploughing, harrowing, stubble picking	Ploughing, harrowing, stubble picking
Seedbed	Raised beds & furrows	Flat
Seed rate	130 kg ha <sup>-1</sup>	150 kg ha <sup>-1</sup>
FYM	20 t ha <sup>-1</sup>	10 t ha
Sand	20 t ha <sup>-1</sup>	-
SSP	460 kg ha <sup>-1</sup>	-
DAP	-	125 kg ha <sup>-1</sup>
Zn	10 kg ha <sup>-1</sup>	-
Sowing	by hand	by hand
Plant density ha <sup>-1</sup>	256600-267600	293200-331200
Ferrous sulphate*	7.5 kg ha <sup>-1</sup>	-
Gypsum	400 kg ha <sup>-1</sup>	-
Herbicide (Alachlor)	3 litres ha <sup>-1</sup>	-
Weedings	1	7
Interculture	-	4
Irrigation	Sprinkler	Sprinkler
Yield kg ha <sup>-1</sup>	ICGS 44 4340 SB XI 3330	3090 2590
Cost of cultivation Rs ha <sup>-1</sup>	8996	8564.2

\* Three sprays

**Table 22. Cost of cultivation in groundnut trials, Taluka Seed Farm, Dhanora, Amraoti district, Maharashtra, post-rainy season, 1987-88.**

Operations/ Inputs	Cost of cultivation (Rs) per plot			
	ICRISAT method		State method	
Variety	ICGS 44	SB XI	ICGS 44	SB XI
Land preparation	97.50	97.50	97.5	97.5
FYM cost and appln. and harrowing	116.25	116.25	72.5	72.5
Sand and appln.	25.00	25.00	-	-
Fertilizers - SSP	48.00	48.00	-	-
Zn SO <sub>4</sub> +Borax + appln.	16.25	16.25	-	-
DAP	-	-	46.42	46.42
Seed cost	157.50	157.50	180.00	180.00
Sowing (dibbling)	35.75	35.75	40.75	40.75
Seed dressing	3.50	3.50	3.50	3.50
Herbicide and application	41.80	41.80	-	-
Weeding and interculture	33.50	33.50	188.50	188.50
Plant protection	21.10	21.10	21.10	21.10
Ferrous sulphate + Urea	15.80	15.80	-	-
Gypsum	35.00	35.00	-	-
Irrigation + Electricity	71.5	71.50	70.00	70.00
Harvesting, cleaning bagging	165.0	165.00	120.00	120.00
Land rent	2.00	2.00	2.00	2.00
Supervision charges	14.15	14.15	14.15	14.15
Cost Rs per plot (0.1 ha)	899.60	899.60	856.42	856.42
Total cost Rs ha	8996.00	8996.00	8564.2	8564.2



**Table 23. Labor used in the ICRISAT and the state method, Taluka Seed Farm, Dhanora, Amraoti district, post-rainy season, 1987-88.**

Operations/Inputs	Labor used (0.4 ha plot)					
	ICRISAT method			State method		
	Bullock pairs	Male	Female	Bullock pairs	Male	Female
Ploughing	2	3	-	2	3	-
Harrowing	2	2	-	2	2	-
Stubble picking	-	-	5	-	-	5
Irrigation	-	1	-	-	1	-
FYM application	-	2	-	-	1	-
Harrowing and levelling	1	1	-	1	1	-
Sand application	-	0.5	-	-	-	-
Seed furrow	0.5	0.5	-	0.5	0.5	-
BBF	-	0.5	-	-	-	-
Fertilizer appln.	-	-	1.5	-	-	1.5
Sowing	-	-	7	-	-	9
Herbicide appln.	-	0.5+0.5	-	-	-	-
Irrigation (11)	-	11	-	-	11	-
Dimethoate spray (2)	-	1	1	-	1	1
Ferrous sulphate (3)	-	1.5	1.5	-	1.5	1.5
Gypsum	-	1	-	-	-	-
Hoeing (4)	-	-	-	2	4	-
Weeding	-	-	7	-	-	41
Harvesting	-	-	47	-	-	35
<b>Total per plot</b>	<b>5.5</b>	<b>26</b>	<b>70</b>	<b>7.5</b>	<b>26</b>	<b>94</b>
per ha-1	13.75	65.0	175	18.75	65.0	235.0
Cost (Rs ha-1)	343.75	650.0	1225.0	468.7	650.0	1645.0
<b>Total labor cost ha-1</b>	<b>2218.75</b>			<b>2763.7</b>		
Rates:	Bullock pair - Rs 25/day					
	Labor M - Rs 10/day					
	Labor F - Rs 7/day					

Table 24. Cost of fertilizers used in the ICRISAT and State methods of groundnut cultivation at Taluka Seed Farm, Dhanora, Amraoti district, post-rainy season, 1987-88.

Fertilizer/ Manure	ICRISAT method			State method		
	Labor	Qty	Cost (Rs)	Labor	Qty	Cost (Rs)
FYM		4 t	200		2 t	100
FYM appln.	2 M	-	20	1 M	-	10
Harrowing	0.5 bullock pair	-	12.5	0.5 bullock pair	-	12.5
Sand	0.5 M	4 t	40.0	0.5 M	-	-
Sand appln.	1 M	-	10.0	-	-	-
SSP		112 kg	96.0	-	-	-
Zn So4		2 kg	16.0	-	-	-
Borax		200 g	6.0	-	-	-
DAP	-	-	-	-	25 kg	86.0
Fertilizer application	1.5 F	-	10.5	1.5 F	-	10.5
Gypsum		100 kg	60.0	-	-	-
Gypsum appln.	1 F	-	7.0	-	-	-
Ferrous sulphate + Urea		500 g	2.50	-	-	-
		200 g	1.10			
Ferrous sulphate application (3 sprays)	1.5 M + 1.5 F	-	25.50			
Rent of sprayer			2.50			
Cost for 0.2 ha plot (Rs)			509.6			219.0
Total cost Rs ha-1			2548.0			1095.0

M = Male labor  
F = Female labor

**Table 25. Cost of weeding and interculture in ICRISAT and State method of groundnut cultivation, Taluca Seed Farm, Dhanora, Amraoti district, Maharashtra, post-rainy season, 1987-88.**

Fertilizer/ Manure	ICRISAT method			State method		
	Labor	Qty	Cost (Rs)	Labor	Qty	Cost (Rs)
Herbicide	-	600 ml	72.0			.
Herbicide	0.5 M	-	5.0			
	0.5 F	-	3.5			
Rent of sprayer	-	-	2.5			
Weeding	-	1	-	-	7	-
Labor for Weeding	7 F	-	49.0	49 F	-	287.0
Hoing and interculture	-	-	-	2 bullock pairs	-	50.0
				4 M	-	40.0
Cost Rs for 0.2 ha plot			132.0			377.0
Total cost Rs ha-1			660.0			1885.0

**Table 26. Soil analysis data, Taluka Seed Farm, Basmat, Parbhani district, Maharashtra, post-rainy season, 1987-88.**

Soil	characteristics	Remarks
Soil type	Light Vertisol	
Soil depth	45 cm	
Previous crop	Pigeonpea	
pH	8.3	High
EC (mmhos/cm)	0.23	Normal
Phosphorus (ppm)	5.0	Deficient
Potash (ppm)	313.0	High
Zinc (ppm)	0.64	Deficient
Iron (ppm)	3.60	Deficient
Manganese (ppm)	7.5	Normal

Table 27. Plant density, yield and ancillary data from groundnut trials at Taluka Seed Farm, Basant, Parbhani district, Maharashtra, post-rainy season, 1987-88.

		Trial I			
		Method of cultivation			
Trial details and yields		ICRISAT		State	
		ICGS 11	SB XI	ICGS 11*	SB XI
Sowing date		20 Jan	20 Jan	1 Feb	1 Feb
Emergence		28 Jan	27 Jan	7 Feb	6 Feb
Plant density ha	-1	299000	297700	163000	197000
Harvest date		27 May	27 May	3 June	3 June
Yield -	-1				
Dry pods kg ha	-1	5260	3440	4020	3180
Haulms kg ha	-1	4930	4900	3700	6000
Shelling (%)		69.0	64.0	66.0	64.0
1000 kernel weight (g)		462	383	458	366
Oil content (%)		47.6	47.5	47.0	48.2
Cost of cultivation (Rs ha-1)		7660	6447	5923	5104

**Table 20. Plant density, yield and ancillary data from groundnut trials at Taluka Seed Farm, Basmat, Parbhani district, Maharashtra, post-rainy season, 1987-88.**

Trial II				
Trial details and yields	Method of cultivation			
	ICRISAT		State	
	ICGS 11	SB XI	ICGS 11	SB XI
Sowing date	1 Feb	1 Feb	1 Feb	1 Feb
Emergence	8 Feb	8 Feb	8 Feb	7 Feb
Plant density ha <sup>-1</sup>	206330	209670	219000	242000
Harvest date	6 Jun	6 Jun	3 Jun	3 Jun
Yield -				
Dry pods kg ha <sup>-1</sup>	4500	3480	4030	3010
Haulms kg ha <sup>-1</sup>	3740	3600	3840	3510
Shelling (%)	68.5	63.0	66.0	67.0
1000 kernel wt (g)	462	383	458	366
Cost of cultivation (Rs ha <sup>-1</sup> )	7660	6447	5923	5104

**Table 29. Yield and ancillary data for groundnut trials on Chikhalthana Seed Farm and farmers' fields, Parbhani district, Maharashtra, post-rainy season, 1987-88.**

LOCATION	Method of cultivation			
	ICRISAT	State	ICRISAT	State
<b>Chikhalthana *</b>				
Sowing date	21 Jan	21 Jan	21 Jan	21 Jan
Variety	ICGS 11	SB XI	ICGS 11	SB XI
Pod yield	2514	952	1657	609
Cost of cultivation	7580	6100	4100	3900
<b>Agdad</b>				
Sowing date	25 Jan	25 Jan	27 Jan	4 Feb
Variety	ICGS 11	SB XI	ICGS 11	SB XI
Pod yield	2800	2167	2400	2133
Cost of cultivation	7165	6321	5421	4700
<b>Tadborgaon</b>				
Sowing date	4 Feb	4 Feb	3 Feb	3 Feb
Variety	ICGS 11	SB XI	ICGS 11	SB XI
Pod yield	1698	1219	1433	848
Cost of cultivation	7060	6220	5220	4745
<b>Malegaon</b>				
Sowing date	29 Jan	29 Jan	29 Jan	29 Jan
Variety	ICGS 11	SB XI	ICGS 11	SB XI
Pod yield	3647	2367	3020	1867
Cost of cultivation	7050	7100	5825	5020
Average yield kg ha <sup>-1</sup>	2665	1676	2127	1364
Average cost of cultivation (Rs ha <sup>-1</sup> )	7214	6435	5141	4591

\* Trial suffered from water stress from May to June

**Table 30. Plant density, yield and ancillary data from groundnut trials at Akluj, Solapur district, Maharashtra, post-rainy season, 1987-88.**

Trial details and yields	Method of cultivation			
	ICRISAT		State	
	ICGS 11	SB XI	ICGS 11	SB XI
Sowing date	16 Jan	16 Jan	16 Jan	16 Jan
Emergence	25 Jan	24 Jan	25 Jan	24 Jan
Plant density ha <sup>-1</sup>	272000	263000*	300000	280000
Harvest date	21 June	21 June	21 June	21 June
Yield -				
Dry pods kg ha <sup>-1</sup>	3110	690	1600	560
Haulms kg ha <sup>-1</sup>	6000	2620	3210	1820
Shelling (%)	69.0	63.0	66.0	67.0
1000 kernel wt (g)	534	356	450	311
Oil content (%)	50.6	47.7	52.2	49.0
Cost of cultivation (Rs ha <sup>-1</sup> )	9975	9975	9325	9325

\* Low yields of SB XI were due to severe attack of BND  
ICGS 11 showed field tolerance to BND.



**Table 31. Cost of cultivation in groundnut trials, Taluka Seed Farm, Akluj, Solapur district, Maharashtra, post-rainy season, 1987-88.**

Operations/Inputs	ICRISAT method	State method
Ploughing (3)	180	120
FYM	250	-
FYM application	120	-
Harrowing	55	120
SSP (200 kg)	176	88
SSP application, cold crushing	60	30
Urea	-	69
Seed	859	892
Seed preparation and related operations	215	210
Cleaning, stubble picking, harrowing	105	80
Borax + application	18	18
Harrowing, marking of field	90	110
BBF preparation	230	-
Seed dressing + application	21	26
Sowing (dibbling)	175	90
Herbicide and application*	140	-
Manual weeding and stirring of soil	280	740
Irrigation (10 including presowing)	230	100
Dimethoate + dimecron	96	107
Ferrous sulphate application	80	-
Gypsum + application	110	-
Harvest, drying, cleaning	500	930
Cost Rs 0.4 ha <sup>-1</sup>	3990	3730
Total cost Rs ha <sup>-1</sup>	9975	9325

\* Cost of herbicide - Alachlor - was not included in the data provided by the trial incharge.

**Table 32. Effect of different cultivation practices on groundnut cv. JL 24 yield and other parameters. Agricultural University Research Farm, Dapoli, Ratnagiri district, Maharashtra, post-rainy season, 1987-88.**

Yield parameters	Treatments					Spacing	
	1	2	3	4	5	30 x 10 cm	30 x 15 cm
Dry pod yield (kg ha <sup>-1</sup> )	3083	5442	4076	4091	4615	4220	4302
Kernel wt (kg ha <sup>-1</sup> )	1961	3880	2612	2746	3202	2888	2872
Straw wt (kg ha <sup>-1</sup> )	6896	11576	6915	7488	6822	8071	7808
No. of mature pods per plant	16.76	25.47	23.52	21.07	25.12	20.79	23.78
Wt of mature pods per plant	16.48	32.01	23.25	19.64	23.67	21.08	22.94
1000 kernel wt (g)	560	612.5	568.7	585.0	587.5	584.5	581.0
Shelling (%)	63.5	71.25	64.37	66.88	69.38	68.0	66.15
Oil content (%)	47.25	48.16	44.74	48.31	48.82	47.62	47.24
Protein content (%)	33.19	33.31	33.69	33.03	34.78	33.75	33.45
Total N uptake at harvest kg ha <sup>-1</sup>	224.12	428.0	267.96	284.4	281.49	300.07	294.34
Total P uptake at harvest kg ha <sup>-1</sup>	15.98	52.69	26.69	28.1	28.04	30.25	30.37

Treatments - 1 Control  
 2 ICRISAT technology  
 3 Glyricidia 10 t ha<sup>-1</sup>  
 4 25 kg N + 50 kg P<sub>2</sub>O<sub>5</sub> (through DAP)  
 5 25 kg N + 50 kg P<sub>2</sub>O<sub>5</sub> + Boron through SSP and boronated superphosphate.

**Table 33. Results of partial adoption of ICRISAT technology on farmers' fields, Parbhani district, Maharashtra, postrainy season, 1987-88.**

Fertilizer	Quantity ha-1	No. fields	No. of pods per plant	Yield kg ha-1
Single super phosphate + Gypsum	500 kg 400 kg	14	23 (5)	2900
+ SSP + Gypsum + Urea	500 kg 282 kg 25 kg	4	21 (3)	3050
SSP	500 kg	5	16 (6)	2130
DAP	100 kg	11	17 (6)	2009

Figures in parentheses indicate immature pods

Table 34. Soil analysis data from Andhra Pradesh.

Location	District	Soil	nN	EC mmhos	NH <sub>4</sub> N	No <sub>3</sub> N	P PPM	K	Zn	Pb	Mn
Mahadeo- manqalam	Chittoor	Alfisol	6.42	0.07	3.5	3.7	7.25	72	2.70	16.0	33.7
Nagalapuram	Chittoor	Chelika	7.26	0.12	4.3	7.2	6.00	66	0.90	16.8	28.0
Kaithumada	Nizamabad	Chelika	5.21	0.08	6.8	11.8	6.75	94	0.30	35.2	37.5
Garikapadu	Krishna	Alfisol	8.26	0.16	6.8	6.3	12.50	119	0.46	7.5	13.0
Reddipalli	Anantapur	Alfisol	7.48	0.16	6.5	7.2	6.75	78	5.50	8.8	23.0
Tangadencha	Kurnool	Alfisol	7.62	0.15	10.9	3.9	4.50	128	0.74	8.8	55.0
Yemmiganur	Kurnool	Alfisol	8.32	0.21	5.0	9.4	25.00	200	1.33	7.8	27.5
Jantial	Karimnagar	Chelika	8.50	0.19	6.7	6.3	27.25	258	0.70	10.4	15.5
Nandipadu	Maloonda	Alfisol	7.38	0.10	1.8	4.6	11.25	54	1.82	11.5	25.5
Nandikotkur	Kurnool	Alfisol	8.30	0.56	-	-	8.00	296	4.00	3.0	8.1
Ponnavaaram	Krishna	Mixed	8.40	0.18	-	-	9.50	269	0.62	2.9	4.0
Jhuri	Kurnool	Alfisol	8.22	0.24	-	-	12.75	140	1.52	1.9	4.5
Rollavaram	Kurnool	Alfisol	8.30	0.56	-	-	8.00	296	4.00	3.0	8.1
Amravathi	Guntur	Alfisol	8.21	0.59	1.3	16.1	15.50	417	10.60	7.6	18.7

- = Data not available

**Table 35. Plant density, yield and ancillary data from groundnut trials at the State Seed Farm, Tangadencha, Kurnool district, Andhra Pradesh, post-rainy season, 1987-88.**

Trial details and yields	Method of cultivation			
	ICRISAT		State	
	ICGS 44	TMV 2	ICGS 44	TMV 2
Sowing date	9 Dec	9 Dec	9 Dec	9 Dec
Plant density ha <sup>-1</sup>	265000	315000	227000	366000
Seed rate ha <sup>-1</sup>	140 kg	160 kg	150 kg	180 kg
Duration*	116 days	116 days	120 days	120 days
Harvest date	9 Apr	9 Apr	9 Apr	9 Apr
Yield				
No. of pods plant <sup>-1</sup>	16.4	12.8	22.2	10.7
Dry pods kg ha <sup>-1</sup>	4366	3570	3065	2260
Haulms kg ha <sup>-1</sup>	3960	4250	3160	3460
1000 kernel wt (g)	551	396	313	300
Shelling (%)	76	73	68	73
Oil content (%)	49.2	47.4	45.5	47.8
Cost of cultivation Rs ha <sup>-1</sup>	10577.03	10555.23	9317.50	9407.50

\* Crop maturity was enhanced by 4-5 days in ICRISAT method.

**Table 36. Cost of cultivation for groundnut trials at the State Seed Farm, Tangadencha, Kurnool district, Andhra Pradesh, post-rainy season, 1987-88.**

Operations/Inputs	Cost			
	Method of cultivation			
	ICRISAT		State	
	ICGS 44	TMV 2	ICGS 44	TMV 2
Ploughing (3) + harrowing (1)	159.0	159.0	159.0	159.0
FYM + application	96.0	96.0	96.0	96.0
Ammonium sulphate	90.0	90.0	0.0	0.0
Super phosphate 75 kg	75.0	75.0	75.0	75.0
Potash 25 kg	39.0	39.0	39.0	39.0
Zinc sulphate 10 kg	30.0	30.0	0.0	0.0
Fertilizer application	47.5	47.5	47.5	47.5
Urea (9 kg)	-	-	30.0	30.0
Urea application	-	-	11.0	11.0
Gypsum	30.0	30.0	35.0	35.0
	(90 kg)	(90 kg)	(100 kg)	(100 kg)
Gypsum application	11.0	11.0	11.0	11.0
Seed @ Rs.9/kg and seed preparation	234.0	230.0	252.0	270.0
Seed dressing	8.0	8.5	9.0	9.0
Sowing	66.0	66.0	24.5	24.5
Gap filling	11.0	11.0	44.0	44.0
Herbicide	62.0	62.0	66.5	66.5
Herbicide application	8.0	8.0	8.5	8.5
Weeding & interculture	45.5	45.5	128.5	128.5
FeSo <sub>4</sub> Appln. (2 sprays)	22.5	22.5		
Irrigation	363.0	363.0	242.0	242.0
Plant protection	110.0	110.0	182.0	182.0
Digging channel and watch and ward	169.0	113.0	169.0	169.0
Harvesting	199.0	199.0	234.0	234.0
<b>Total cost Rs plot-1</b>	<b>1819.25</b>	<b>1815.5</b>	<b>1863.5</b>	<b>1881.5</b>
<b>Plot size</b>	<b>0.1720 ha</b>	<b>0.1720 ha</b>	<b>0.20 ha</b>	<b>0.20 ha</b>
<b>Total cost Rs ha-1</b>	<b>10577.03</b>	<b>10555.23</b>	<b>9317.5</b>	<b>9407.5</b>

**Table 37. Plant density, yield and ancillary data from groundnut trials at the Project Demonstration and Development Farm, Yigannur, Kurnool district, Andhra Pradesh, post-rainy season, 1987-88.**

Trial details and yields	Method of cultivation			
	ICPISAT		State	
	ICGS 44	TMV 2	ICGS 44	TMV 2
Sowing date	5 Dec	5 Dec	5 Dec	5 Dec
Sowing method	Dibbling	Dibbling	Seed drill	Seed drill
Emergence	17 Dec	17 Dec	17 Dec	17 Dec
Percentage emergence	100	100	98	90
Plant density ha <sup>-1</sup>	275000	350000	322000	289000
Harvest date	5 Apr	7 Apr	5 Apr	7 Apr
Duration	120 days	122 days	120 days	120 days
Yield kg ha <sup>-1</sup>				
Dry pods	2520*	1820	1980	1540
Haulm				
Shelling (%)	72	75	69	74
1000 kernel wt (g)	531	373	449	383
Oil (%)	44.4	44	45.2	42.4
Cost of cultivation				
Rs ha <sup>-1</sup>	8256.9	8256.9	9335.6	9335.6

\* does not account for about 20% pod loss in soil.

**Table 38. Cost of cultivation in ICRISAT and State method of groundnut cultivation, Yemmiganur, Kurnool district, Andhra Pradesh, post-rainy season, 1987-88.**

Operations/Inputs	Cost of cultivation (Rs)	
	ICRISAT method	State method
Ploughing	60.0	60.0
Tilling and harrowing	30.0	30.0
Breaking clods, stubble picking	112.5	142.5
BBF preparation	40.0	-
FYM	160.0 (8 t)	160.0 (8 t)
FYM spreading	32.5	32.5
SSP	145.5 (250 kg)	122.5 (125 kg)
Ammonium sulphate	34.0 (20 kg)	51.0 (30 kg)
Zinc sulphate + application	61.35	61.35
Muriate of potash	26.0 (20 kg)	26.0 (20 kg)
Top dressing	-	51.0 (30 kg)
Ammonium sulphate + appln.	-	11.0
Fertilizer application	18.0	18.0
Gypsum	70.0 (200 kg)	70.0 (200 kg)
Seed	600.0 (60 kg)	600.0 (60 kg)
Sowing	90.0	97.0
Gap filling	33.0	44.0
Ferbicide + application	97.5	97.5
Weeding and interculture	363.0 (2 weedings)	772.0 (5 weedings)
Irrigation	294.0	127.5
Plant protection	284.5	431.0
Harvesting	635.9	709.5
Other charges	-	19.5
Cost Ps plot-1 (0.4 ha)	3202.75	3733.25
Total cost Ps ha-1	8056.88	9334.6



**Table 39. Plant density, yield and ancillary data from groundnut trials at the Project Development and Demonstration Farm, Mahadeomangalam, Chittoor district, Andhra Pradesh, post-rainy season, 1987-88.**

Trial details and yields	ICRISAT method		State Method	
	ICGS 11	TNV 2	ICGS 11	TNV 2
Sowing date	17 Dec	17 Dec	17 Dec	17 Dec
Plant population (,000/ha)	148.4	175.2	157.0	214.0
Harvest date	12 Apr	4 Apr	12 Apr	4 Apr
Average pod plant <sup>-1</sup>	16	13	11	9
Yield (kg ha <sup>-1</sup> )	1500	1320	1050	1280
1000 kernel wt (g)	255	297	205	261
Shelling (%)	62	68	61	65
Oil (%)	46.7	44.1	44.6	44.9
Dry haulm wt kg ha <sup>-1</sup>	1960	1500	1750	1960

**Table 40. Cost of cultivation for groundnut trials at Mahadev Mangalam, Chittoor district, Andhra Pradesh, post-rainy season, 1987-88\*.**

Operations/Inputs	Cost of cultivation (Rs)	
	ICRISAT method	State method
Ploughing	310.0	310.0
Harrowing	35.0	35.0
PYM	300.0 (3 t)	300.0 (3 t)
Ammonium sulphate	18.0 (10 kg)	
Single super phosphate	130.0 (115 kg)	75.00
Potash	14.0 (10 kg)	16.00 (12.5 kg)
Zinc sulphate	12.5 (2.5 kg)	-
Seed	290.0 (29 kg)	260.0 (26 kg)
Thiram	6.0	6.0
Irrigation	44.25	37.0
Plant protection	110.0 (4 sprays)	65.0 (2 sprays)
Cost (Rs) per plot (0.2 ha)	1269.75	1104.00
Total cost Rs ha <sup>-1</sup>	6348.75	5520.00

\* Cost of cultivation is not inclusive of labor charges and harvest charges for both the practices and gypsum and ferrous sulphate application in the ICRISAT method. Therefore, the cost of cultivation appears to be lower by about Rs. 2000 ha<sup>-1</sup> for both methods.

**Table 41. Plant density, yield and ancillary data from groundnut trials, at the Project Development and Demonstration Farm, Garikapadu, Krishna district, Andhra Pradesh, post-rainy season, 1987-88.**

Trial details and yields	ICRISAT method		State method	
	ICGS 11	JL 24	ICGS 11	JL 24
Sowing date	24 Nov	24 Nov	24 Nov	24 Nov
Harvest date	24 Mar	14 Mar	24 Mar	14 Mar
Plant population (,000 ha <sup>-1</sup> )	189	224	110	213
Yield (kg ha <sup>-1</sup> )	1850	1960	0950	1490
Average No. of pods plant <sup>-1</sup>	13.29	8.89	13.38	9.6
1000 kernel wt (g)	463	456	460	393
Shelling (%)	75	76	71	74
Oil (%)	44.4	44.0	45.2	42.4
Dry haulm wt (kg ha <sup>-1</sup> )	2360	2000	1360	1880

**Table 42. Cost of cultivation for groundnut trials at the Project Development and Demonstration Farm, Garikapadu, Krishna district, Andhra Pradesh, post-rainy season, 1987-88.**

Operations/Inputs	Cost of cultivation (Rs)			
	ICRISAT variety	State variety	ICRISAT variety	State variety
	ICRISAT method		State method	
Land preparation	126.0	126.0	108.0	108.0
FYM cost & application	100.0	100.0	-	-
Fertilizer	93.0	93.0	107.5	107.5
Seed cost	280.0	224.0	160.0	240.0
Cost of sowing	86.4	86.4	38.4	38.0
Plant protection	235.5	235.5	143.0	143.0
Weeding cost	115.0	115.0	38.0	38.0
Gypsum and application	29.0	29.0	48.0	48.0
Irrigation	150.0	150.0	75.0	75.0
Ferrous sulphate	7.5	7.5	6.2	6.2
Harvesting	249.5	249.5	192.0	192.0
Cost per plot (0.2 ha)	1471.90	1415.90	1016.10	995.70
Total cost Rs ha <sup>-1</sup>	7359.50	7079.5	5080.50	4978.5

Table 43. Chemical analysis of soils at sowing at trial locations in Orissa, post-rainy season, 1987-88.

Location	Treatment	pH	EC mmhos cm-1	Available ppm					
				Na	P	K	Fe	Zn	Mn
Khurda b	ICRISAT practice	7.15	0.3	12.3	76.3	96	148	5.6	23.8
	State practice	6.96	0.19	13.5	89.4	128	196	3.1	24.3
Sakhigopal <sup>a</sup>	ICRISAT practice + ICGS 44	6.82	0.30	13.6	27.0	28	173	0.54	7.5
	ICRISAT practice + AK 12-24	5.96	0.15	10.1	26.0	28	190	0.60	13.0
	State practice + ICGS 44	5.15	0.09	11.7	8.75	13	180	2.10	28.8
	State practice + AK 12-24	5.24	0.15	12.5	11.25	19	185	1.10	26.3

a - Total of  $\text{NH}_4$  - N and  $\text{NO}_3$  - N

b - At Khurda, lime was added to both ICRISAT and State practice plots.

c - At Sakhigopal, lime was added only to ICRISAT Practice plots.

**Table 44. Plant density, yield and ancillary data of groundnut trials at Khurda, Puri district, Orissa, post-rainy season, 1987-88.**

Trial details and yields	ICRISAT practice		State practice	
	ICGS 44	AK 12-24	ICGS 44	AK 12-24
Sowing date	3 Dec 87	3 Dec 87	4 Dec 87	4 Dec 87
Plant density	289000	272000	278000	281000
Dry pod yield (kg ha <sup>-1</sup> )	4450	3020	3560	2600
Haulm fresh wt <sup>a</sup> (kg ha <sup>-1</sup> )	10250	12330	7750	11380
Shelling (%)	77	80	77	77
1000 kernel wt (g)	461	369	473	339
Oil content (%)	45.0	45.1	44.4	44.6

a - Average of 4 unit areas each measuring 10 m<sup>2</sup>

**Table 45. Cost of cultivation of groundnut, at Khurda, Puri district, Orissa, post-rainy season, 1987-88.**

Operations/Inputs	Cost of cultivation per plot	
	ICRISAT practice (0.113 ha)	State practice (0.1173 ha)
Ploughing	50	30
Harrowing	10	-
Land preparation (making BBP manually)	140	-
Picking of stubbles	170	80
Farm yard manure including labor charges	150	160
Ammonium sulphate	10.70	22.10
Super phosphate	27.30	28.50
Muriate of potash	5.10	10.50
Lime	337	266
Seed and sowing	292	298
Irrigation	248	248
Gypsum*	32.4	-
Plant protection	388	388
Harvesting	320	290
Cost Rs plot-1	2180.50	1821.10
Total cost Rs ha-1	19296.40	15525.10

\* Cost of gypsum was not included in the data provided by the farm manager.

Note: The cost of cultivation appears to be on the higher side. When these costs were discussed with Mr. B.N. Rath, R.C. Sahu and S.M. Patnaik, they revised the cost of cultivation for ICRISAT method to about Rs.11300 ha-1 and for the State method, about Rs. 9500 ha-1. The estimates are comparable to the data from the other location in Orissa, and those from other states.

**Table 46. Plant density, yield and ancillary data of groundnut trials at Sakhigopal, Puri district, Orissa, post-rainy season, 1987-88.**

Trial details and yields	ICRISAT practice		State practice	
	ICGS 44	AK 12-24	ICGS 44	AK 12-24
Sowing date	8 Dec 87	8 Dec 87	9 Dec 87	9 Dec 87
Nodulation (nodules plant <sup>-1</sup> 42 days after sowing)	115	94	77	33
Plant density	242000	255000	252000	252000
Dry pod yield (kg ha <sup>-1</sup> )	3670	2500	2570	2170
Shelling (%)	76	77	75	74
1000 kernel wt (g)	448	349	450	363
Oil content (%)	48.30	47.30	47.10	46.70
Haulm fresh wt <sup>a</sup> (kg ha <sup>-1</sup> )	10800	10900	10080	10550

a - Average of 4 unit areas each measuring 10 m<sup>2</sup>.



**Table 47. Cost of cultivation of groundnut yield maximization trials at Sakhigopal, Puri district, Orissa, post-rainy season, 1987-88.**

Operations/Inputs	Cost of cultivation per plot (Rs)	
	ICRISAT practice (0.36 ha)	State practice (0.29 ha)
Ploughing	100	100
Harrowing	40	50
Land preparation (making BBF and picking of stubbles)*	1000	200
Farm yard manure including labor charges	288	232
Ammonium sulphate	31	51
Super phosphate	182	74
Muriate of potash	42	27
Lime	578.50	-
Seed and sowing	612	400
Irrigation	448	294
Gypsum**	111.46	-
Plant protection	350	350
Harvesting	400	400
Cost Rs plot-1	4182.96	2178.00
Total cost Rs ha-1	11619.30	7510.30

\* The cost of making BBF is considerably higher than the other locations in Orissa and those in other states.

\*\* Cost of gypsum was not included in the data provided by the farm manager.

Table 48. Statement showing area and average yield per hectare of post-rainy groundnut in Kheda district of Gujarat from 1983-87.

Taluka	1983		1984		1985		1986		1987	
	Area (ha)	Yield (kg/ha)	Area (ha)	Yield (kg/ha)	Area (ha)	Yield (kg/ha)	Area (ha)	Yield (kg/ha)	Area (ha)	Yield (kg/ha)
Kadiad	5067	2620	7056	2400	7965	2200	490	1760	3127	1600
Anand	11016	2600	14125	2300	7287	1800	2166	1625	6941	1550
Thasra	2107	2400	2867	2000	1416	2200	356	1540	1935	1400
Borsad	2642	2380	2907	1820	1944	2000	800	1580	1311	1550
Patlad	2811	2400	4993	1800	2899	2000	900	1600	3643	1520
Matar	1695	2500	1251	2100	728	2200	101	1480	1747	1380
Mahmadabad	304	2000	616	1600	83	1500	70	800	9	560
Kapadwanj	449	1800	767	1600	52	1200	19	600	11	480
Rajasinor	258	1800	571	1500	108	1200	7	560	15	450
Khamhat	243	2550	1180	2360	407	2400	71	1590	688	1400
Total/ Average	28612	2305	38326	1948	17889	1870	4980	1314	21422	1189

Source: Reddy, P.S. (1987). Unpublished report of the study team on the falling post-rainy groundnut yields in Kheda district, Gujarat.

**Table 49. Physical and chemical properties of soils in Kheda district, Gujarat.**

Constituent	Anand	Kapad- wanj	Khambhat	Tharva	Nadiad	Potlad	Bornad	Mahame- had	Natar	Raja- sinor
<b>Mechanical composition</b>										
i. Sand	61.5	74.1	45.6	58.6	70.5	76.1	72.0	71.0	80.1	72.5
ii. Silt	25.0	21.7	21.5	10.0	6.5	18.2	12.8	8.5	6.0	7.5
iii. Clay	12.5	15.5	21.0	23.3	14.5	10.8	9.2	20.0	8.3	14.0
Texture	Sandy loam	Sandy loam	Silty Clay/clay loam	Sandy loam	Sandy loam	Sandy loam	Sandy clay/loam	Sandy loam	Sandy loam	Loamy sandy
pH (1-2.5)	8.3	8.2	7.0	7.4	7.6	7.6	8.8	7.2	8.6	7.6
EC mmhos/cm (1:1)	0.33	0.33	0.67	0.50	0.4	0.55	0.55	0.33	2.14	0.45
Organic Carbon	0.40	0.40	0.77	0.80	0.78	0.56	1.00	1.05	0.66	0.58
Total N (%)	0.28	0.21	0.051	0.048	0.04	0.033	0.062	0.054	0.03	0.04
Available P mg/100 g	1.1	0.2	1.2	5.1	3.70	1.46	3.5	2.8	1.30	4.20
Available K mg/100 g	14.7	11.0	28.6	22.2	9.6	9.2	27.8	17.4	12.0	14.2
Fertility Status	L.M	L.M	M.H	L.H	L.M	L.M	M.H	M.H	L.M	M.H
N, P <sub>2</sub> O <sub>5</sub> , K <sub>2</sub> O										

Source: Reddy, P.S. (1987). Unpublished report of the study team on the falling post-rainy season, groundnut yields in Kheda District of Gujarat.

L = Low, M = Medium, H = High.

**Table 50. Plant density, yields and ancillary data for groundnut yield maximisation trials at Nadiad, Gujarat, post-rainy season, 1987-88.**

Trial details and yields	ICRISAT package		State package	
	ICRISAT variety	State variety	ICRISAT variety	State variety
Variety	ICGS 11	GG 2	ICGS 11	GG 2
Sowing date	18 Jan 88	18 Jan 88	18 Jan 88	18 Jan 88
Plant density ha <sup>-1</sup>	169000	184000	76000	84000
1000 dry kernal wt (g)	37.1	42.9	36.0	37.6
Shelling %	68	72	67	70
Pod yield (kg ha <sup>-1</sup> )	1901	1846	1151	1279
Haulm yield (kg ha <sup>-1</sup> )	3400	3600	3080	3760
Oil content %	52.3	52.7	51.4	43.9

**Table 51. Cost of cultivation in groundnut yield trials at Taluka Seed Farm, Nadiad, Kheda district, Gujarat, post-rainy season, 1987-88.**

Operations/Inputs	ICRISAT practice		State practice	
	ICRISAT variety	State variety	ICRISAT variety	State variety
Preparatory tillage	604	604	233	233
Manures and manuring	1149	1149	796	796
Seed and Sowing	2825	2825	1993	1993
Irrigation	154	154	88	88
Insecticides	1011	1011	1770	1770
Weedicides and weeding				
Harvesting	825	825	825	825
<b>Total cost Rs ha<sup>-1</sup></b>	<b>6568</b>	<b>6568</b>	<b>5705</b>	<b>5705</b>

**Table 52. Plant density, yields and ancillary data for groundnut trials at Borjavi, Gujarat, postrainy season, 1987-88.**

Trial details and yields	ICRISAT practice		State practice	
	ICRISAT variety	State variety	ICRISAT variety	State variety
Variety	ICGS 44	GG 2	ICGS 44	GG 2
Sowing date	17-1-88	17-1-88	17-1-88	17-1-88
Plant density ha-1	187000	60000	197000	134000
1000 dry kernel wt (g)	41.7	34.5	36.9	31.6
Shelling %	72	67	68	66
Oil content %	53.7	49.2	51.4	50.4
Pod yield (kg ha-1)	1775	710	1718	915
Haulm yield (kg ha-1)	4700	4020	7240	6220

**Table 53: Cost of cultivation in groundnut yield trials at Taluka Seed Farm, Boriavi, Kheda district, Gujarat, post-rainy season, 1987-88.**

Operations/Inputs	ICRISAT practice		State practice	
	ICRISAT variety	State variety	ICRISAT variety	State variety
Preparatory tillage	604	604	233	233
Manure and manuring	1269	1269	946	946
Seed and Sowing	2603	2603	1993	1993
Irrigation	132	132	88	88
Insecticides, weedicides and weeding	879	879	1330	1330
Harvesting	825	825	825	825
<b>Total cost (Rs ha-1)</b>	<b>6312</b>	<b>6312</b>	<b>5415</b>	<b>5415</b>

**Table 54. Package of practices followed for groundnut yield maximization trials, Musaravakkam, Chengalput district, Tamil Nadu, post-rainy season, 1987-88.**

Operations/ Inputs	ICRISAT method	State method
Tillage	Three ploughings and one harrowing by a tractor.	Three ploughings and one harrowing by a tractor
Fertilizers/ha	FYM = 20 t Am.sul = 50 kg SSP = 500 kg MOP = 80 kg ZnSo4 = 10 kg	FYM = 12.5 t Urea = 55 kg SSP = 400 kg MOP = 75 kg MN.Mix = 12.5 kg
Sowing date	16-12-1987	15-12-1987
Seed bed	Broadbeds	Flat
Varieties	ICGS 44 and CO 2	ICGS 44 and CO 2
Seed rate	127 kg/ha	125 kg/ha
Spacing	30 x 10 cm	30 x 10 cm
Seed dressing	Thiram 3 g/kg	Thiram 4g/kg + Rhizo 200 g
Sowing	By placement of seed in seed furrows	By dibbling
Weedings	3 in ICGS 44 & 4 in CO 2	4 in ICGS 44 & 5 in CO 2
Gypsum	400 kg/ha on 35th day	200 kg/ha on 35th day
FeSO4	2 sprays @ 2.5 kg/ha	-
Pesticide applications	6 in ICGS 44; 10 in CO 2: 1-Dimethoate 750 ml+ Bavistin 250 g/ha 2-Dimethoate 750 ml/ha. 1-Endosulfan 1.25 L/ha 1-Decis 375 ml/ha. 1-Dithane M 45 1.25 kg/ha. *1-NPV 200 Larval Eq./ha *2-Chloropyrifos 1.25L/ha. *1-Decis 375 ml+Dithane M 45 1.25 kg/ha *1-Monocrotophos 1.5 L/ha	4 in ICGS 44 ; 8 in CO 2: 1-Endosulfan 1.25 L + Dithane M 45 1.25 kg/ha 1-Endosulfan 1.25 L/ha 1-Decis 375 ml+Dithane M 45 1.25 kg/ha. 1-Bavistin 250 g/ha *1-NPV 200 Larval Eq./ha *2-Chloropyrifos 1.25 L/ha. *1-Monocrotophos 1.5 L/ha *1-NPV 200 Larval Eq./ha
Irrigations	20 by sprinkler	16 by check-basin
Harvest date	27-3-1988	27-3-1988

\* applied only on CO 2



**Table 55. Plant density, yield and ancillary data from groundnut trials, Musaravakkam, Chengalout district, Tamil Nadu, post-rainy season, 1987-88.**

Trial details and yields	Method of cultivation			
	ICRISAT package		State package	
	ICGS 44	CO 2	ICGS 44	CO 2
Plant density (,000/ha)	247	268	255	318
Yield (kg ha-1)	2280	2040	2350	2270
1000 dry kernel wt (g)	527	485	463	433
Shelling (%)	76	72	75	67
Oil (%)	46.4	47.1	47.5	48.2
Pods plant-1	11	8	11	8

**Table 56. Cost of cultivation of groundnut yield maximization trials, Musaravakkam, Chengalpet district, Tamil Nadu, post-rainy season, 1987-88.**

Operations/Inputs	Method of cultivation			
	ICRISAT method		State method	
	ICGS 44	CO 2	ICGS 44	CO 2
Land preparation	262.50	267.50	185.00	205.00
Manures and fertilizers	317.00	317.60	305.70	258.15
Seeds and sowing	421.00	410.00	415.00	407.00
Interculture/Weeding	261.00	128.50	192.00	190.00
Irrigation	200.00	241.50	160.00	170.00
Plant protection	203.75	360.50	163.30	304.80
Harvesting	241.50	190.00	186.50	186.50
Cost per 0.2 ha (Rs)	1906.75	1915.60	1607.50	1721.45
-1				
Total cost Rs ha	9533.75	9578.00	8037.50	8607.25

**Table 57. Package of practices followed for groundnut yield maximisation trials, Puttur district Chennai, Tamil Nadu, post-rainy season, 1987-88.**

Operations/ Inputs	ICRISAT method	State method
Tillage	Three ploughings and one harrowing by a tractor.	Three ploughings and one harrowing by a tractor
Fertilizers/ha	FYM = 20 t Urea = 50 kg SSP = 500 kg MOP = 100 kg ZnSo = 10 kg	FYM = 12.5 t Urea = 60 kg * SSP = 577.5 kg MOP = 75 kg MN.mix = 12.5 kg
Sowing date	15-12-1987	15-12-1987
Seed bed	Broadbeds	Flat
Varieties	ICGS 44 and CO 2	ICGS 44 and CO 2
Seed rate	124 kg/ha for ICGS 44 124 kg/ha for CO 2	125 kg/ha for ICGS 44 120 kg/ha for CO 2
Spacing	30 x 10 cm	30 x 10 cm
Seed dressing	Thiram 3 g/kg	Thiram 4 g/kg
Sowing	By placement of seed in seed furrows	By dibbling
Weed control	3 hand weeding	3 hand weeding
Gypsum	400 kg/ha on 35th day	200 kg/ha on 35th day
Pesticide applications	4 sprays: 1-Chloropyrifos 1.0 L+ Bavistin 250 g/ha 1-Quinalphos 1.0 L+ Bavistin 250 g/ha. 1-Dithane M 45 1.2 kg/ha. 1-Chloropyrifos 1.0 L/ha.	4 sprays: 1-Chloropyrifos 1.0 L+ Bavistin 250 g/ha. 1-Quinalphos 1.0 + Bavistin 250 g/ha. 1-Dithane M 45 1.2 kg/ha 1-Chloropyrifos 1.0 L/ha.
Irrigations	13 by sprinkler	10 by check-basin
Harvest date	27-3-1988	28-3-1988

\* applied only on CO 2

Table 58. Plant density, yield and ancillary data from groundnut trials, Puttur, Chennai district, Tamil Nadu, post-rainy season, 1987-88.

Trial details and yields	Method of cultivation			
	ICRISAT package		State package	
	ICGS 44	CO 2	ICGS 44	CO 2
Plant density ('000)	268	269	270	291
Yield (kg ha <sup>-1</sup> )	3560	2480	3600	2370
1000 dry kernel wt (g)	527	449	491	402
Shelling (%)	74	77	72	76
Oil (%)	47.0	38.0	46.5	46.8
Pods plant <sup>-1</sup>	15	11	14	13

**Table 59. Cost of cultivation of groundnut yield maximization trial Puttur, Chengalput district, Tamil Nadu, post-rainy season, 1987-88.**

Operations/Inputs	Method of cultivation			
	ICRISAT package		State package	
	ICGS 44	CO 2	ICGS 44	CO 2
Land preparation	168.50	168.50	186.50	186.50
Manures and fertilizers	305.85	305.85	261.25	261.25
Seeds and sowing	346.00	336.00	382.50	372.50
Interculture/Weeding	165.60	189.60	250.80	250.80
Irrigation	70.00	90.00	100.00	110.00
Plant protection	183.00	183.00	183.00	183.00
Harvesting	420.00	420.00	420.00	420.00
Cost per 0.2 ha (Rs)	1658.95	1692.95	1784.05	1784.05
-1				
Total cost Rs ha	8294.75	8464.75	8920.25	8920.25

Table 60. Package of practices followed for groundnut yield maximization trials, Neyveli, South Arcot district, Tamil Nadu, post-rainy season, 1987-88.

Operations/ Inputs	ICRISAT method	State method
Ploughage	Three ploughings and one harrowing by a tractor.	Three ploughings and one harrowing by a tractor
Fertilizers/ha	FYM = 20 t Urea = 50 kg SSP = 250 kg MOP = 100 kg ZnSo = 10 kg	FYM = 20 t Urea = 8.25 kg DAP = 76.25 kg MOP = 87.5 kg ZnSO = 5 kg
Sowing date	3-12-1987	8-12-1987
Seed bed	Broadbeds	Flat
Varieties	ICGS 44 and CO 2	ICGS 44 and CO 2
Seed rate	125 kg/ha	125 kg/ha
Spacing	30 x 10 cm	30 x 10 cm
Seed dressing	Thiram 3 g/kg	Thiram 4 g/kg
Sowing	By placement of seed in seed furrows	By dibbling
Weed control	2 interculturations 2 hand-weedings	- 2 hand-weedings
Gypsum	400 kg/ha on 35th and 400 kg/ha on 55th day	400 kg/ha on 45th day -
Pesticide applications	5 in ICGS 44 & 4 in CO 2: 2-Chloropyrifos 875 ml+ Monocrotophos 375 ml+ Bavistin 250 g/ha 1-Endosulfan 750 ml+ Bavistin 250 g/ha. 1-Dichorvos 375 ml+ Endosufan 625 ml+ Dithane M 45 1.2 kg/ha. *1-Benlate 1.0 kg/ha.	3 in both varieties: 2-Chloropyrifos 875 ml+ Monocrotophos 375 ml+ Bavistin 250 g/ha. 1-Endosulfan 750 ml+ Bavistin 250 g/ha. - -
Irrigations	10 by sprinkler	9 by check-basin
Harvest date	CO 2 on 14-3-1988 ICGS 44 on 21-4-1988	CO 2 on 18-4-1988 ICGS 44 on 23-3-1988

\* applied only for ICGS 44

Table 61. Plant density, yield and ancillary data of groundnut yield maximisation trials, Neyveli, South Arcot district, Tamil Nadu, post-rainy season, 1987-88.

Trial details and yields	Method of cultivation			
	ICRISAT practice		State practice	
	ICGS 44	CO 2	ICGS 44	CO 2
Plant population (,000/ha-1)	317	291	291	272
Yield (kg ha-1)	3160	2930	2260	2300
1000 dry kernel wt (g)	571	520	463	426
Shelling (%)	82	80	73	72
Oil (%)	45.3	48.8	44.7	47.5
Pods plant-1	13	12	12	12

**Table 62. Cost of cultivation of groundnut yield maximization trials, Neyveli, South Arcot district, Tamil Nadu, post-rainy season 1987 - 88.**

Operations/Inputs	Method of cultivation			
	ICRISAT practice		State practice	
	ICGS 44	CO 2	ICGS 44	CO 2
Land preparation	132.50	132.50	236.50	236.50
Manures and fertilizers	302.00	302.00	120.00	120.00
Seeds	400.00	400.00	400.00	400.00
Sowing	136.00	136.00	88.00	88.00
Weeding and interculture	246.00	246.00	154.25	154.25
Irrigation	129.50	114.50	176.00	130.00
Plant protection	301.25	220.10	247.22	175.10
Harvesting	200.00	200.00	200.00	200.00
Cost (Rs) per 0.2 ha plot	1847.25	1751.10	1621.97	1503.85
Cost Rs ha <sup>-1</sup>	9236.25	8755.50	8109.85	7519.25



**Table 63. Cost of cultivation and yield of groundnut in farmers' field, Rettanai, South Arcot district, Tamil Nadu, post-rainy season, 1987-88.**

Operations/Inputs	Cost per 0.2 ha		
	ICRISAT package		State package
	ICGS 44	CO 1	CO 1
Land preparation	110.00	110.00	77.00
PYM	150.00	150.00	100.00
Fertilizers	196.50	196.50	187.50
Seed	400.00	310.00	310.00
Thiram for seed treatment	5.25	5.00	5.00
Rhizobium	-	-	3.00
Sowing	24.00	24.00	20.00
Weedicide and its application	67.50	67.50	-
Hand weeding	62.00	62.00	80.00
Gypsum & its application	24.00	24.00	12.00
Plant protection	282.00	239.50	277.50
Irrigation (sprinkler)	85.00	85.00	121.00
Harvest and postharvest	100.00	100.00	100.00
Cost (Rs) per 0.2 ha plot	1506.25	1373.50	1293.00
-1			
Total cost Rs ha	7531.25	6867.50	6465.00
Yield kg/plot	480	405	393
Yield kg ha-1	2400	2025	1965

**Table 64. Package of practices followed for groundnut yield maximization trials, Guladhalli, Raichur district, Karnataka, post-rainy season, 1987-88.**

Operations/ Inputs	ICRISAT method	State method
Tillage	One ploughing and one harrowing	One ploughing and one harrowing
Fertilizers/ha	FYM = 20 t Am. sul = 50 kg SSP = 250 ZnSo = 10 kg	FYM = 12 t DAP = 200 kg MOP = 62.5 kg -
Sowing date	11-12-1987	11-12-1987
Seed bed	Broadbeds	Ridges
Varieties	ICGS 44 and S 206	ICGS 44 and S 206
Seed rate	140 kg/ha	150 kg/ha
Spacing	30 x 10 cm	30 x 10 cm
Seed dressing	Thiram 3 g/kg	Thiram 2 g/kg
Sowing	By placement of seed in seed furrows	By dibbling
Weed control	Alachlor 3.0 L/ha, 4 interculturations and 4 hand weeding	- 2 interculturations and 1 hand weeding
Gypsum	400 kg/ha on 35th day	600 kg/ha on 35th day
Pesticide applications	4 sprays: 2-Dimethoate 660 ml/ha 1-Monocrotophos 750 ml/ha 1-Dithane M 45 1.2 kg+ Dimethoate 660 ml/ha	3 sprays: 2-Dimethoate 660 ml/ha 1-Monocrotophos 750 ml/ha -
Irrigations	19 by sprinkler	16 by check-basin
Harvest date	18-4-1988	20-4-1988

**Table 65. Plant density, yield and ancillary data of groundnut yield maximisation trials, Guladhalli, Raichur district, Karnataka, post-rainy season, 1987-88.**

Trial details and yields	Method of cultivation			
	ICRISAT package		State package	
	ICGS 44	S 206	ICGS 44	S 206
Plant density (,000)	276	253	231	252
Yield (ka ha-1)	3600	2270	2930	2510
1000 drv kernel wt (g)	499	352	322	353
Shellina (%)	75	74	65	70
Oil (%)	45.2	47.6	45.4	45.1
Pods plant-1	18	15	19	17

**Table 66. Cost of cultivation of groundnut yield maximisation trials, Guladhalli, Raichur district, Karnataka, post-rainy season, 1987-88.**

Operations/Inputs	Method of cultivation			
	ICRISAT package		State package	
	ICGS 44	S 206	ICGS 44	S 206
Land preparation	138-00	138-00	135-00	135-00
Manures and fertilizers	489-00	489-00	362-00	362-00
Seeds* and sowing	722-00	722-00	728-00	728-00
Weedicide & its application	80-00	80-00	-	-
Interculture/Weeding	96-00	96-00	94-00	94-00
Irrigation	190-00	190-00	160-00	160-00
Plant protection	282-00	282-00	175-00	175-00
Harvesting	298-00	306-00	320-00	320-00
Cost per 0.2 ha plot (Rs)	2295-00	2303-00	1974-00	1974-00
Total cost Rs ha	11475-00	11515-00	9870-00	9870-00

\* The farm manager estimated the cost of the seed @ Rs 20/kg. This is on a higher side than the estimates made other locations in Karnataka.

**Table 67. Package of practices followed for groundnut yield maximization trials, Turkondona, Raichur district, post-rainy season, 1987-88.**

Operations/ Inputs	ICRISAT method	State method
Tillage	One ploughing and one harrowing	One ploughing and one harrowing
Fertilizers/ha	FYM = 25 t Am. sul = 125 kg SSP = 500 kg MOP = 62.5 kg ZnSo = 10 kg	FYM = 7.5 t DAP = 150 kg MOP = 62.5 kg - -
Sowing date	25-12-1987	25-12-1987
Seed bed	Broadbeds	Flat
Varieties	ICGS 44 and KRG 1	ICGS 44 and KRG 1
Seed rate	125 kg/ha	150 kg/ha
Spacing	30 x 10 cm	30 x 10 cm
Seed dressing	Thiram 3 g/kg of seed	Thiram 2 g/kg of seed
Sowing	By placement of seed in seed furrows	By 3-tine seed-drill
Weed control	Alachlor 3.0 L/ha and 3 hand weeding	- 3 hand weeding
Gypsum	400 kg/ha on 30th day	500 kg/ha on 30th day
Pesticide applications	4 sprays: 2-Dimethoate 660 ml/ha 1-Monocrotophos 750 ml+ Dithane M 45 1.2 kg/ha 1-Polidol dust 25 kg/ha	3 sprays: 2-Dimethoate 660 ml/ha 1-Monocrotophos 750 ml+ Dithane M 45 1.2 kg/ha -
Irrigations	19 by sprinkler	16 by check-basin
Harvest date	19-4-1988	22-4-1988

**Table 68. Yield and ancillary data for groundnut yield maximization trials at Turkondona, Raichur district, Karnataka, post-rainy season, 1987-88.**

Trial details and yields	Method of cultivation			
	ICRISAT package		State package	
	ICGS 44	KRG 1	ICGS 44	KRG 1
Plant density (.000)	373	318	188	197
Yield (kg ha <sup>-1</sup> )	4770	2370	1990	970
1000 dry kernel wt (g)	509	393	424	334
Shellina (%)	73	66	67	68
Oil (%)	48.4	46.5	48.9	46.1
Pods plant <sup>-1</sup>	15	12	14	11

**Table 69. Cost of cultivation of groundnut yield maximization trials, Turkondona, Raichur district, Karnataka, post-rainy season, 1988-88.**

Operations/ Inputs	Method of cultivation			
	ICRISAT package		State package	
	ICGS 44	KRG 1	ICGS 44	KRG 1
Land preparation	202.50	202.50	177.50	177.50
Manures and fertilizers	314.50	314.50	150.00	150.00
Seeds and sowing	350.00	350.00	330.00	330.00
Weedicide & its application	80.00	80.00		
Interculture/Weeding	230.00	230.00	260.00	260.00
Irrigation	50.00	50.00	60.00	60.00
Plant protection	112.50	112.50	70.00	70.00
Harvesting	150.00	150.00	150.00	150.00
Cost per 0.2 ha plot (Rs)	1489.50	1489.50	1197.50	1197.50
Total cost Rs ha	7447.50	7447.50	5987.50	5987.50

**Table 70. Package of practices followed for groundnut yield maximization trials, R.K. Shala, Bangalore district, Karnataka, post-rainy season, 1987-88.**

Operations/ Inputs	ICRISAT method	State method
Tillage	Two ploughings and one harrowing by a tractor.	Two ploughings and one harrowing by a tractor
Fertilizers/ha	FYM = 20 t Lime = 2.5 t Am. sul = 50 kg SSP = 500 kg MOP = 67.5 kg ZnSo = 20 kg	FYM = 20 t Lime = 2 t Am. sul = 125 kg SSP = 470 kg MOP = 62.5 kg -
Sowing date	29-12-1987	29-12-1987
Seed bed	Broadbeds	Flat
Varieties	ICGS 11 and TMV 2	ICGS 11 and TMV 2
Seed rate	140 kg/ha	150 kg/ha
Spacing	30 x 10 cm	30 x 10 cm
Seed dressing	Thiram 3 g/kg	Thiram 2 g/kg
Sowing	By placement of seed in seed furrows	By dibbling
Weed control	Alachlor 3.0 L/ha and 3 hand weeding	- 2 hand weeding
Gypsum	400 kg/ha on 40th day	600 kg/ha on 40th day
FeSo4	2 sprays @ 2.5 kg+ 1 kg urea/ha on 40 th & 50 th day of emergence	1 spray of FeSo4 only, @ 2.5 kg/ha
Pesticide applications	4 sprays: 1- Dimethoate 660 ml/ha 1- Monocrotophos 750 ml/ha Dithane M 45 1.2 kg/ha. 1- Dimethoate 660 ml/ha 1- Monocrotophos 750 ml+ Dithane M 45 1.2 kg/ha.	4 sprays: 1- Dimethoate 660 ml/ha 1- Monocrotophos 750 ml/ha Dithane M 45 1.2 kg/ha 1- Dimethoate 660 ml/ha 1- Monocrotophos 750 ml+ Dithane M 45 1.2 kg/ha
Irrigations	12 by sprinkler	10 by check-basin
Harvest date	30-4-1988	2-5-1988



**Table 71. Plant density, yield and ancillary data for groundnut trials at R.K. Shala, Bangalore district, Karnataka, post-rainy season, 1987-88.**

Trial details and yields	Method of cultivation			
	ICRISAT package		State package	
	ICGS 11	TMV 2	ICGS 11	TMV 2
Plant density ('000/ha)	189	248	232	256
Yield (kg ha <sup>-1</sup> )	3850	3350	4310	3170
1000 dry kernel wt (g)	500	402	459	392
Shellina (%)	75	74	68	75
Oil (%)	49.5	46.8	48.6	46.8
Pods plant <sup>-1</sup>	23	21	20	19

**Table 72. Cost of cultivation of groundnut yield maximization trials, R.K. Shala, Bangalore district, Karnataka, post-rainy season, 1987-88.**

Operations/Inputs	Method of cultivation			
	ICRISAT package		State package	
	ICGS 11	TMV 2	ICGS 11	TMV 2
Land preparation	78.00	78.00	83.00	83.00
Manures and fertilizers	880.00	880.00	445.00	445.00
Seeds and sowing	556.50	456.50	556.50	456.00
Weedicide & its application	80.00	80.00		
Weeding and interculture	120.00	120.00	140.00	140.00
Irrigation	170.00	180.00	170.00	170.00
Gypsum application	97.50	97.50	97.50	97.50
Plant protection	226.50	226.50	226.50	226.50
Harvesting	410.00	370.00	480.00	470.00
FeSO <sub>4</sub> +urea & DAP application	94.50	25.50	94.50	12.50
Cost Rs 0.2 ha <sup>-1</sup>	2713.00	2514.00	2293.00	2100.50
Total cost Rs ha <sup>-1</sup>	13565.00	12570.00	11465.00	10502.50

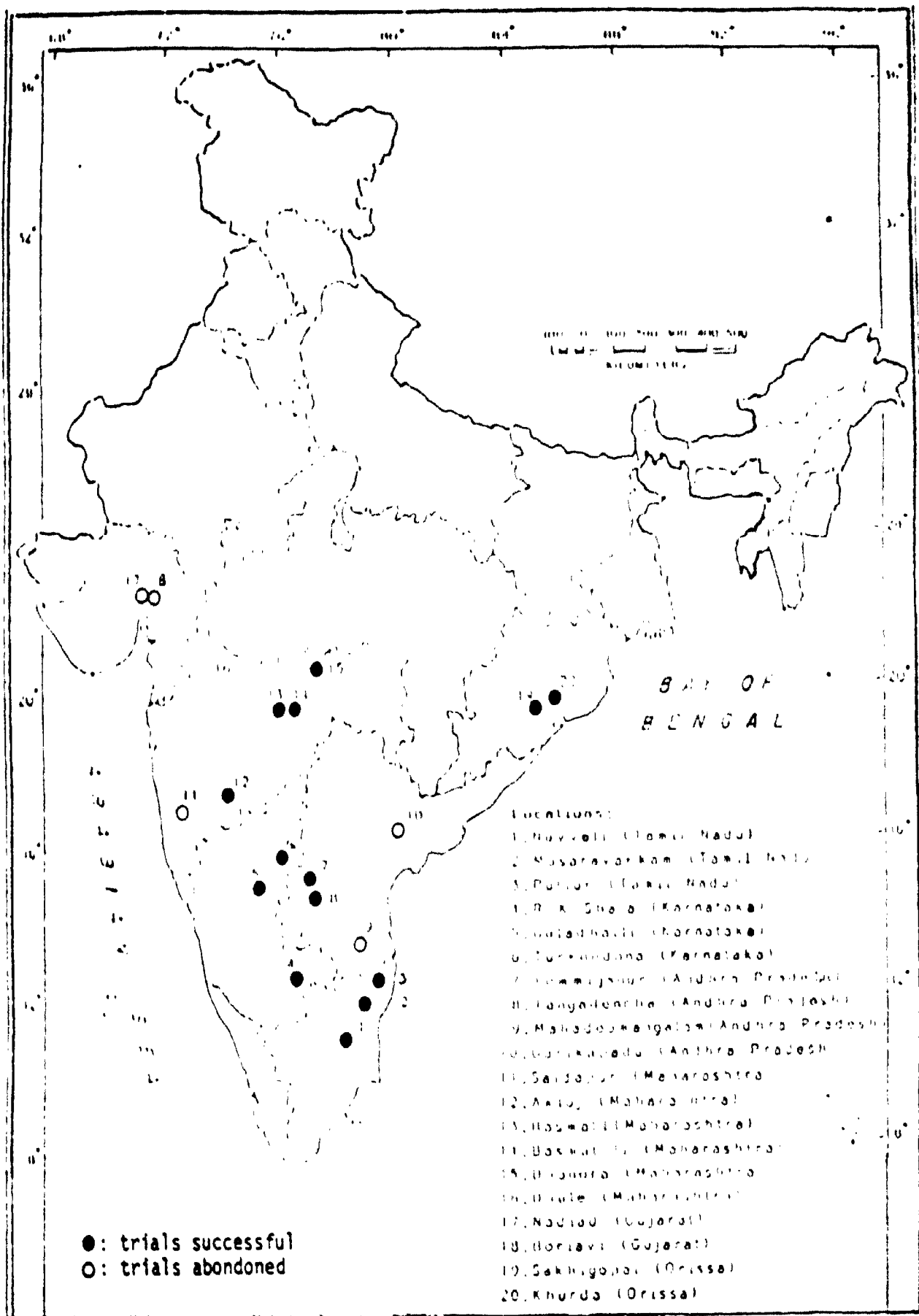
**Table 73. Package of practices followed by the farmer to grow TMV 2 under ICRISAT and State methods, Kalamala, Manvi Taluka, Raichur district, Karnataka, post-rainy season, 1987-88.**

Field operations	ICRISAT package	State package
Land preparations	One ploughing & one harrowing	One ploughing & one harrowing
Fertilizer/ha	Am. sul = 125 kg SSP = 500 kg MOP = 62.5 kg	DAP = 150 kg MOP = 62.5 kg -
Sowing date	16 January 1987	27 December 1987
Variety	TMV 2	TMV 2
Seed bed	Broadbed-and-furrows	Flat land
Seed rate	125 kg/ha	150 kg/ha
Sowing	By placement of seed in seed-furrows	By seed drill
Weed control	3 hand weeding	3 hand weeding
Gypsum	500 kg/ha	500 kg/ha
Plant protection	4 sprays: 1) Nuvacron 2) Dithane M 45+Nuvacron 3) Chloropyrifos 4) Chloropyrifos	4 sprays: 1) Nuvacron 2) Dithane M 45+ Nuvacron 3) Chloropyrifos 4) Chloropyrifos
Irrigations	6 by furrows	6 by furrows
Date of harvesting	04-5-1988	16-4-1988

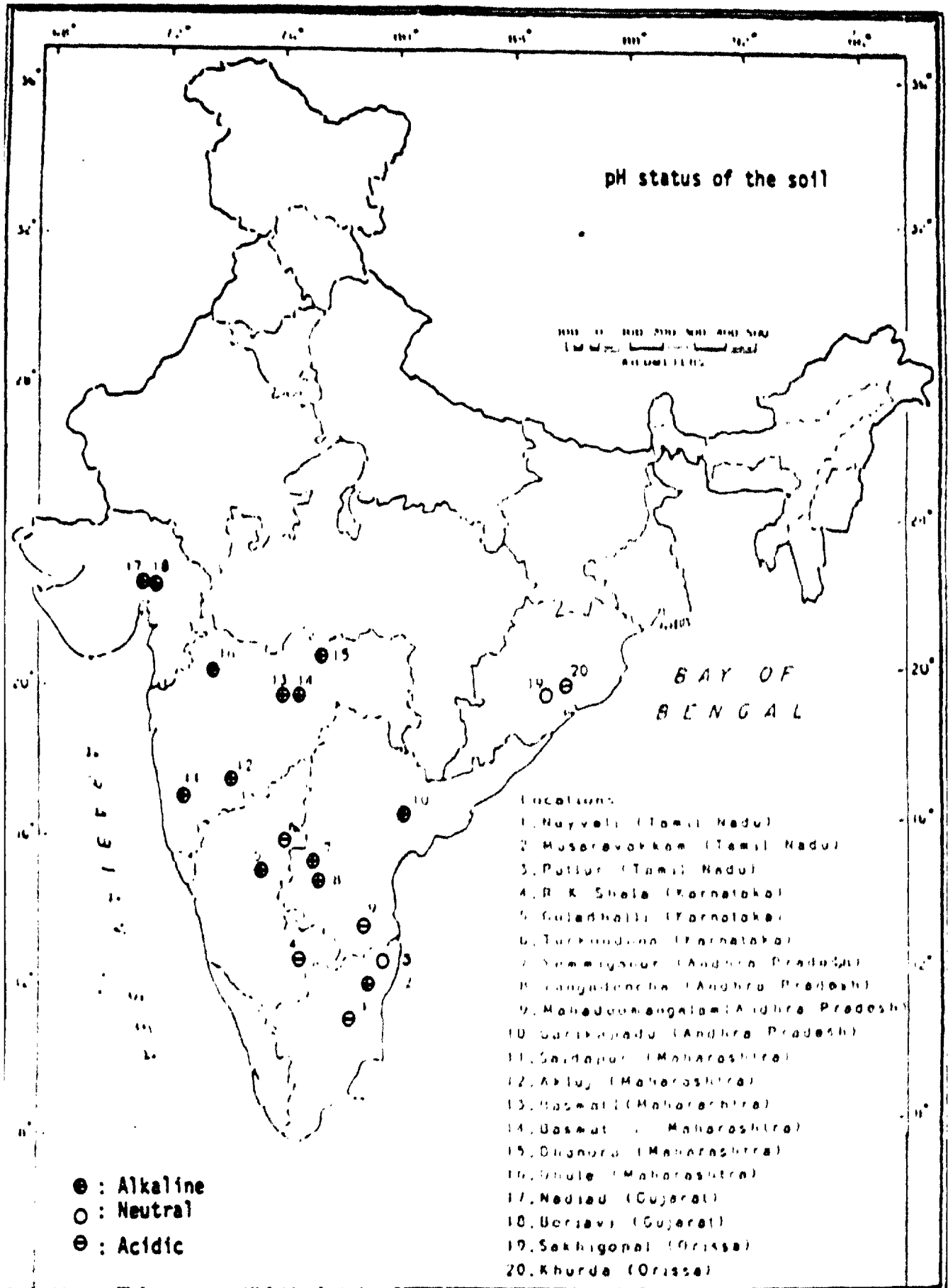
**Table 74. Cost of cultivation of TMV 2 in farmer's field under ICRISAT and State methods, Kalamala, Manvi Taluka, Raichur district, Karnataka, post-rainy season, 1987-88.**

Operations/ Inputs	Method of cultivation	
	ICRISAT method	State method
Ploughing	175	175
Preparation of beds	60	-
Seeds	250	300
Fertilizers	173.50	147.50
Sowing	50	25
Weeding	130	200
Plant protection	130	130
Irrigation	30	30
Harvesting, cleaning, bagging	100	125
Cost for 0.2 ha <sup>-1</sup> plot (Rs)	1098.50	1132.50
Total cost Rs ha <sup>-1</sup>	5492.50	5662.50
Yield kg ha <sup>-1</sup>	3800	1780
Shelling (%)	76	73.5

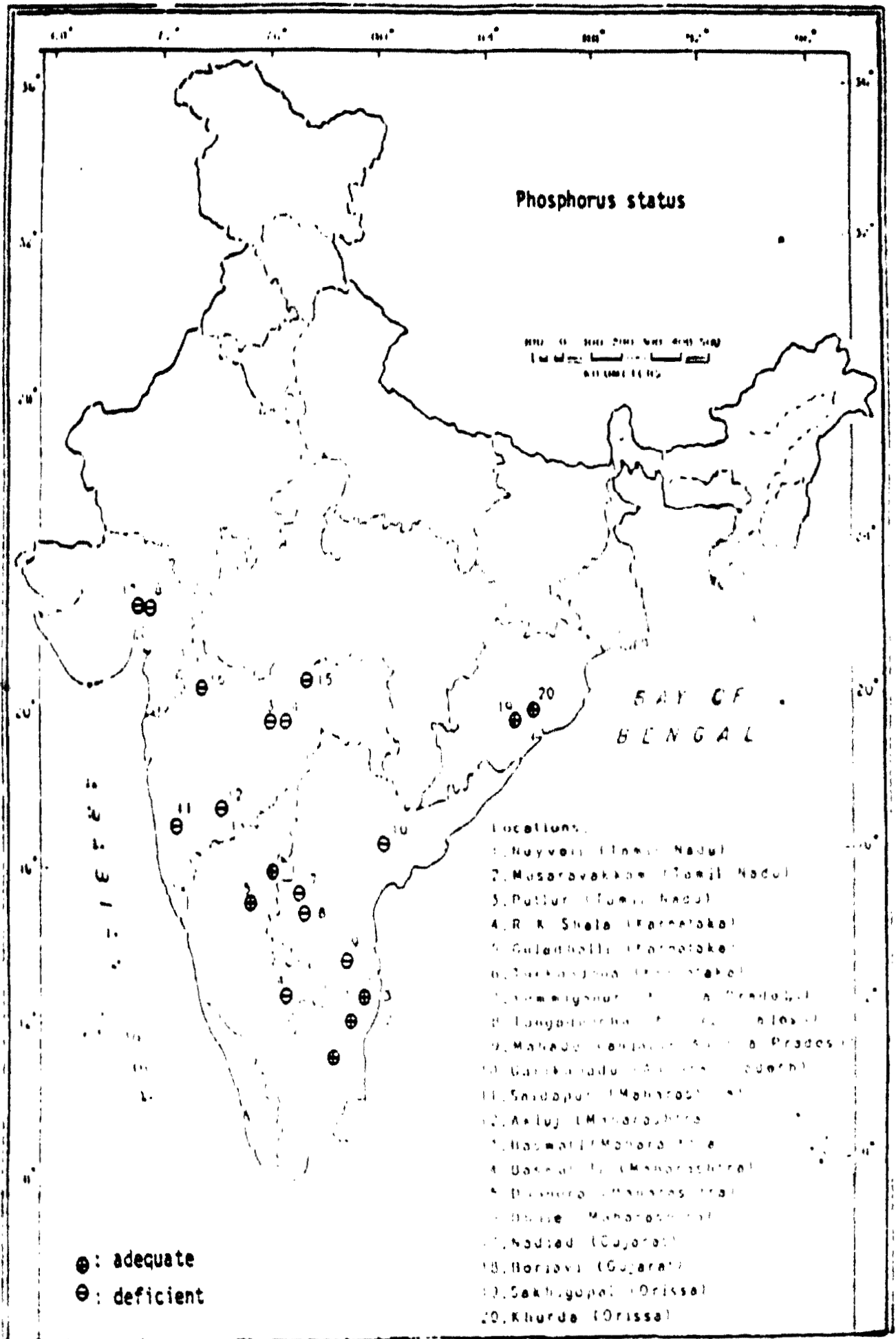
Appendix 1. Map of India showing groundnut yield maximisation trial locations, Post rainy season, 1987 - 88.



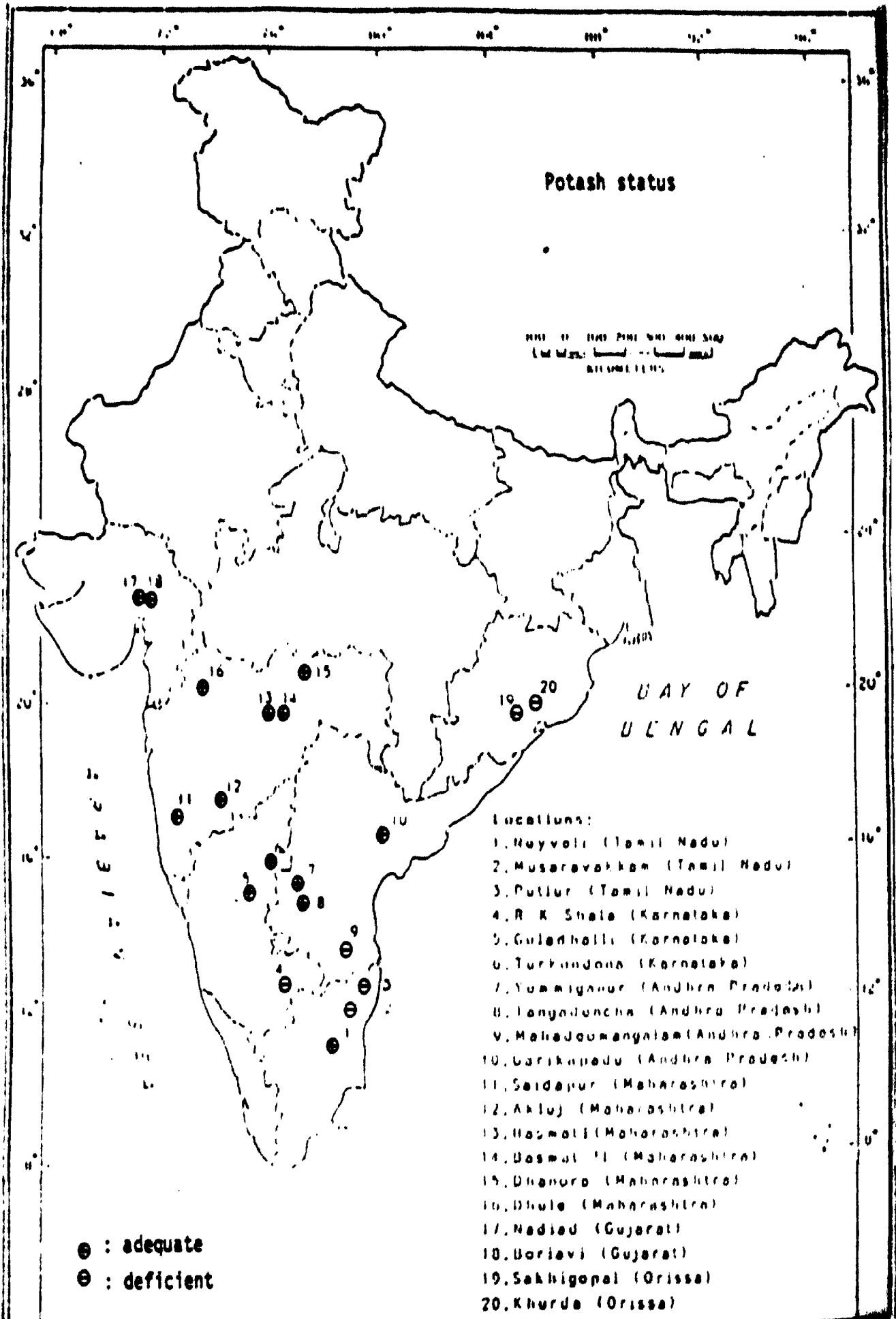
Appendix 2. Map of India showing groundnut yield maximisation trial locations, Post rainy season, 1987 - 88.



Appendix 3. Map of India showing groundnut yield maximisation trial locations, Post rainy season, 1987 - 88.

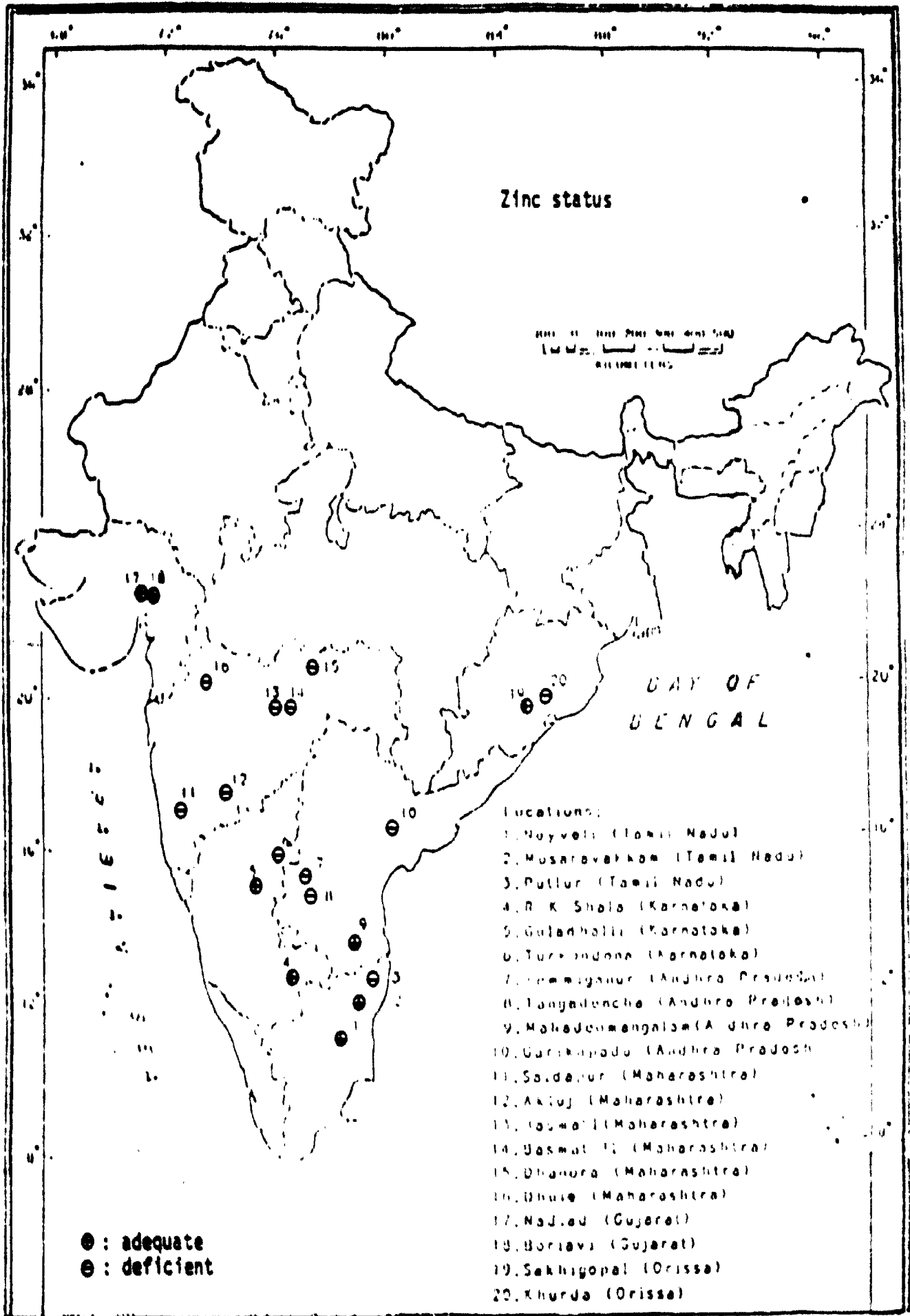


Appendix 4. Map of India showing groundnut yield maximisation trial locations, Post rainy season, 1987 - 88.

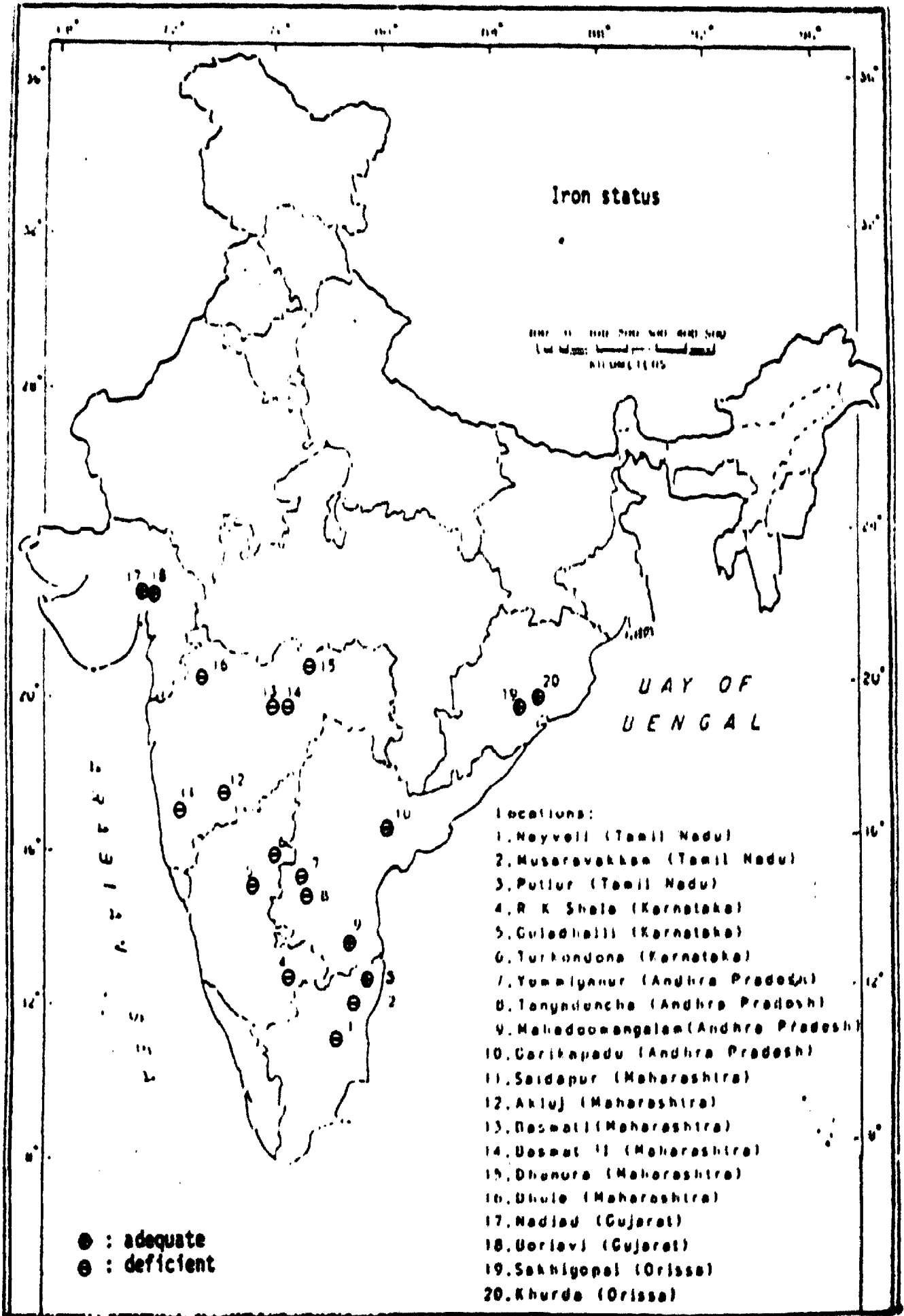


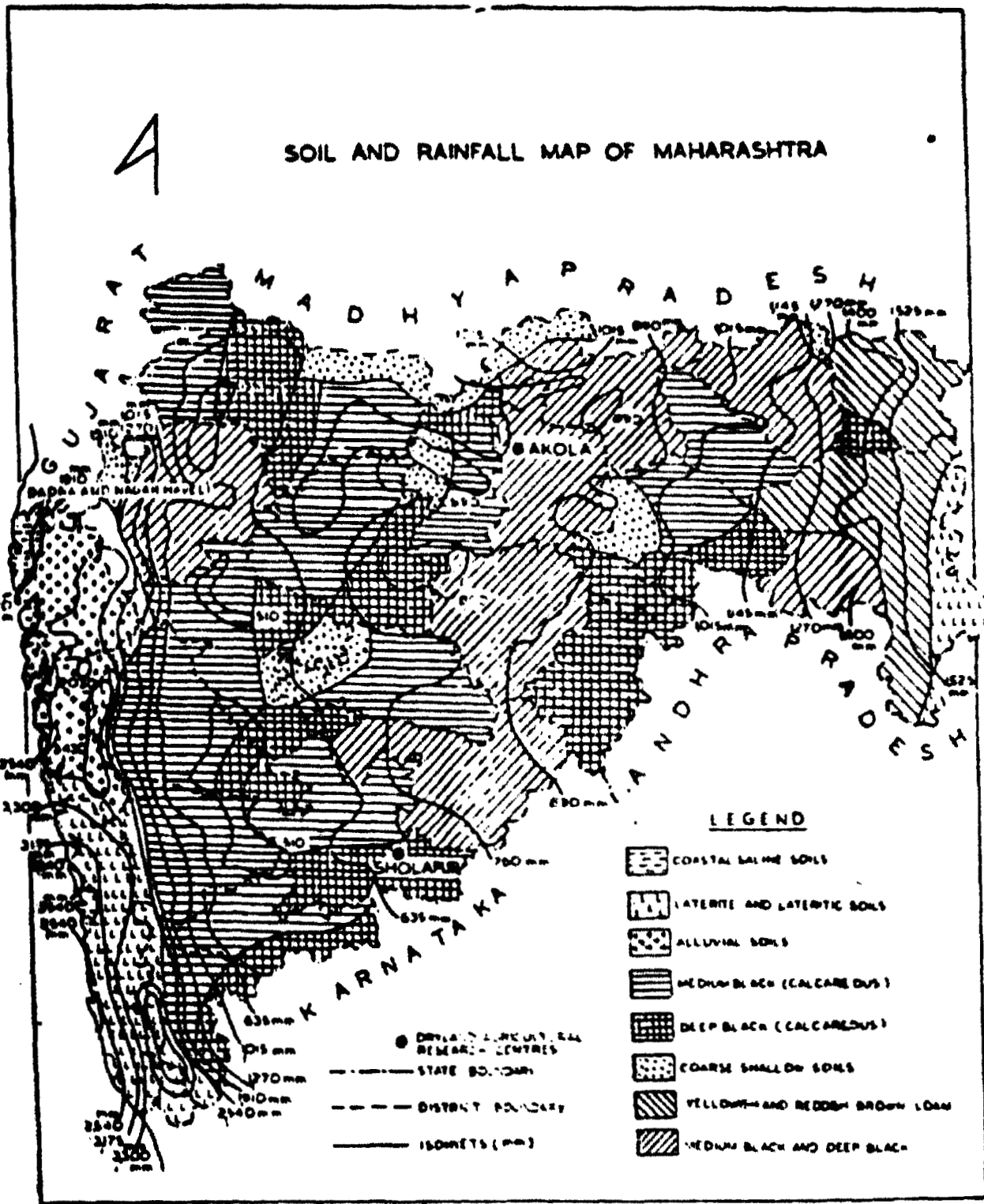


Appendix 5. Map of India showing groundnut yield maximisation trial locations, Post rainy season, 1987 - 88.



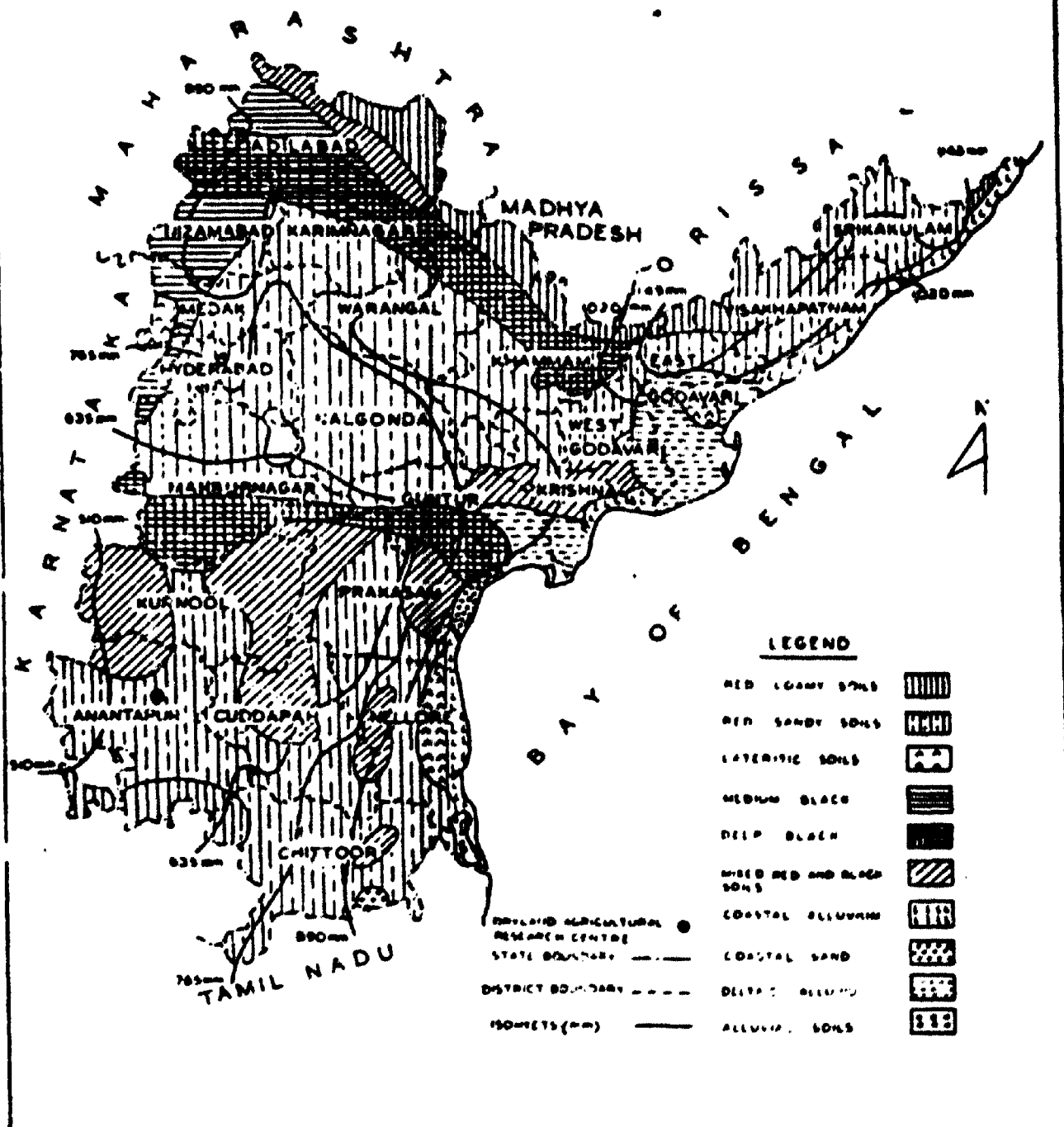
Appendix 6. Map of India showing groundnut yield maximisation trial locations, Post rainy season, 1987 - 88.



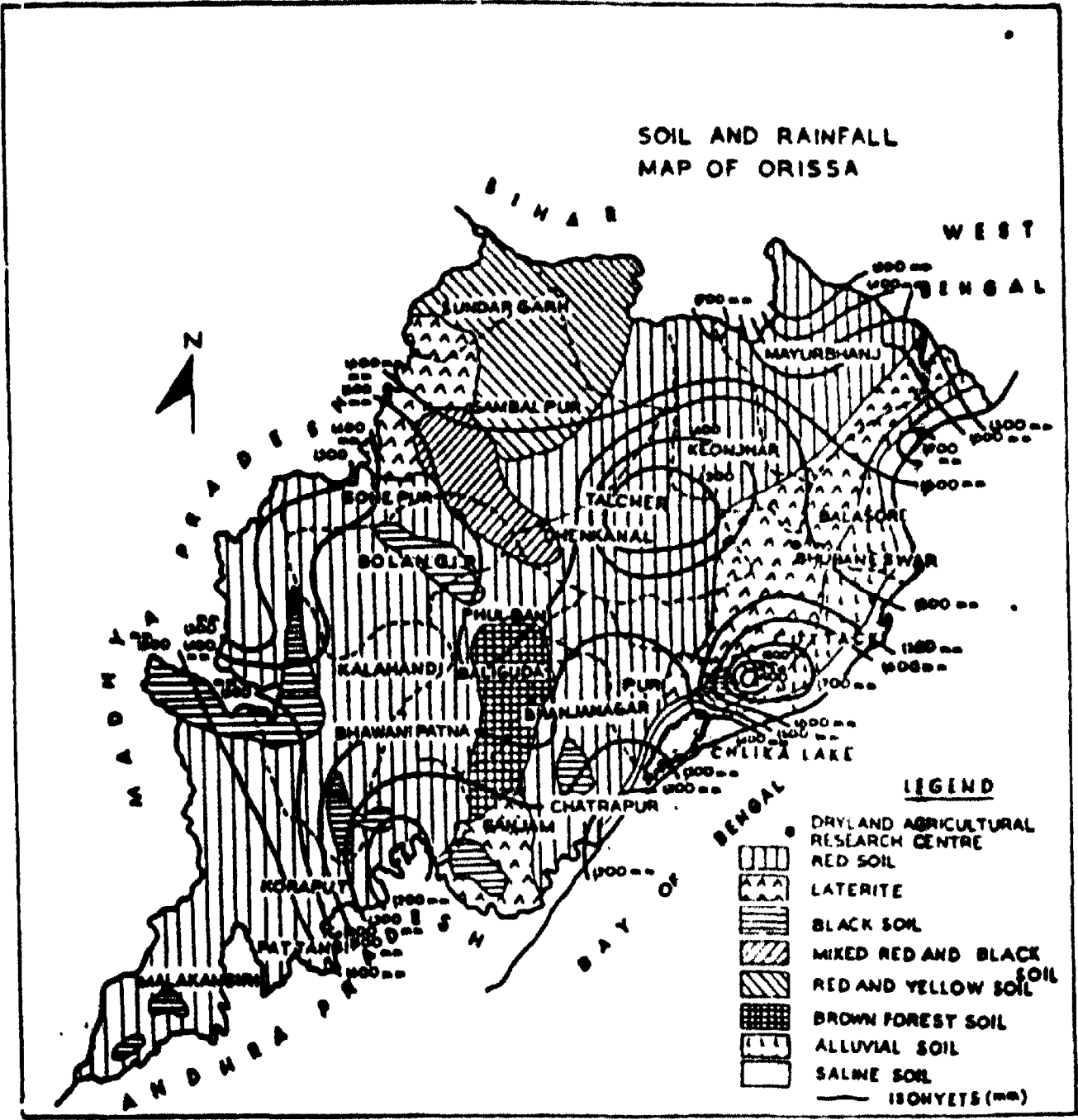


Soil and rainfall map of Maharashtra

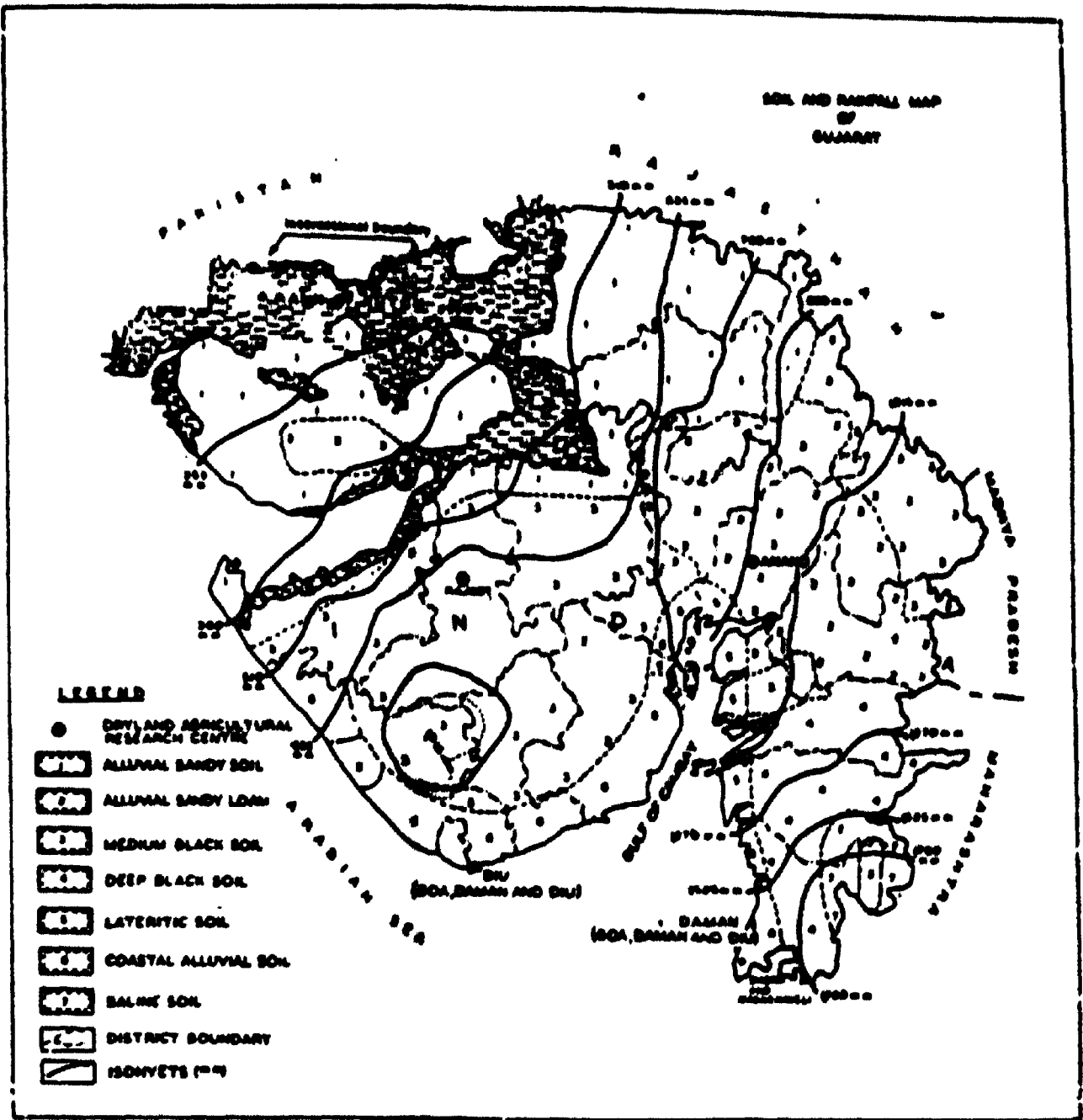
## SOIL AND RAINFALL MAP OF ANDHRA PRADESH



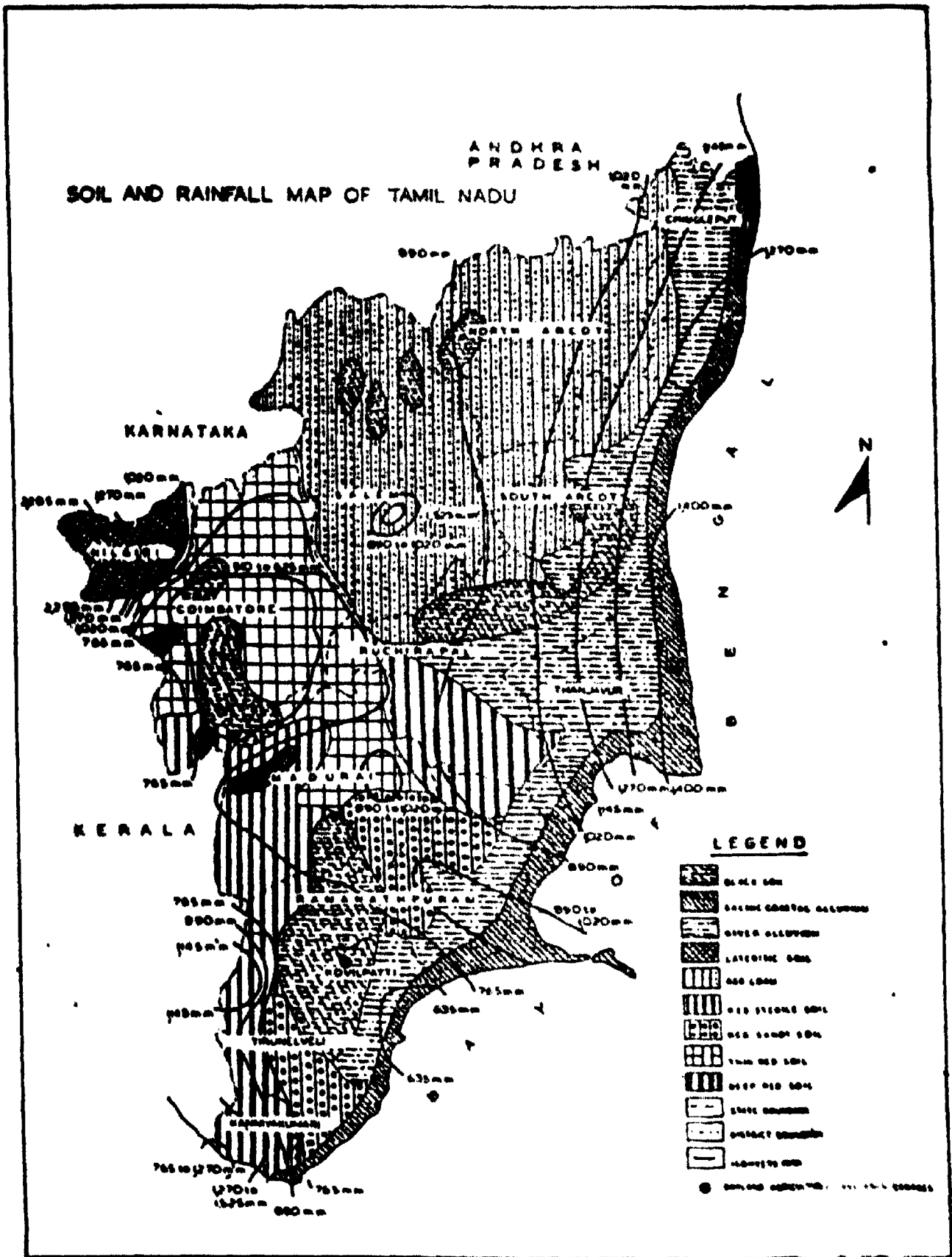
Soil and rainfall map of Andhra Pradesh



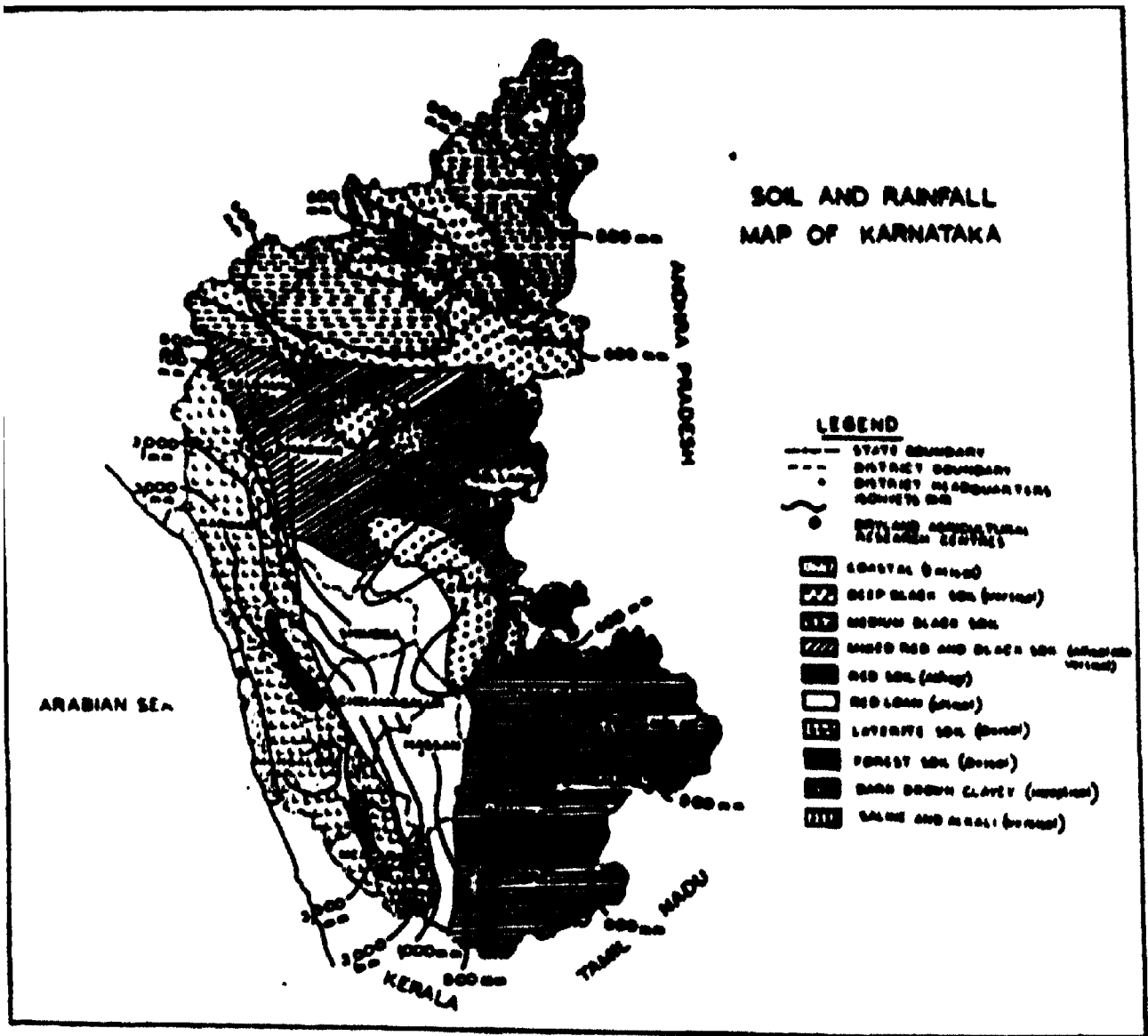
Soil and rainfall map of Orissa



**Soil and rainfall map of Gujarat**



Soil and rainfall map of Tamil Nadu



Soil and rainfall map of Karnataka