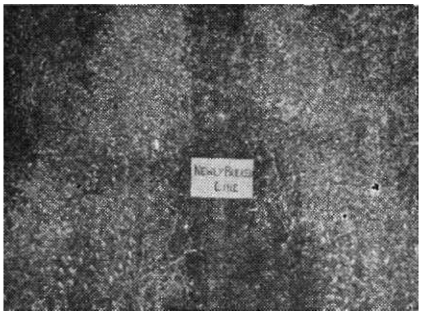
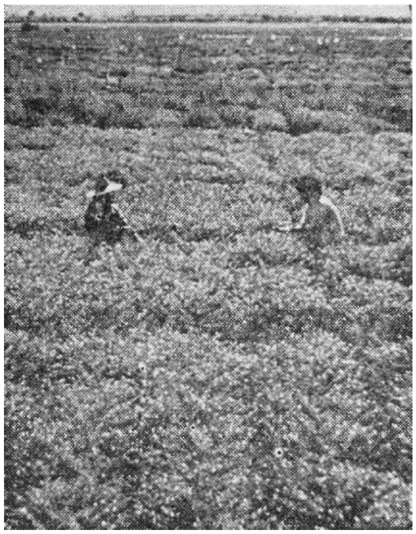


Chickpea newly bulked line



Chickpea breeding plots

GLOBAL RESEARCH ON PULSES

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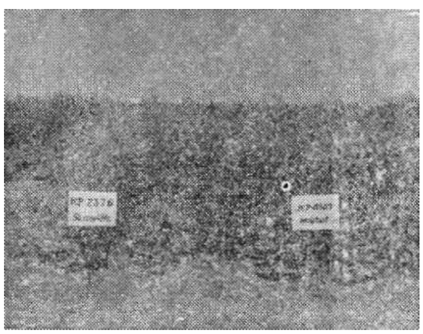
A good crop of chickpea

Scientists from several countries visiting ICRISAT chickpea field

SEVERAL pulse crops are grown around the world and approximately 62 million tons are produced on over 82 million hectares. Their relative importance differs from country to country and region to region. It is impossible to discuss research being carried out internationally on all these crops and therefore for the purpose of this article we have selected three pulse crops; namely, pigeonpea, chickpea, and lentil. The main reason for selecting these crops is their importance in the diet of the people as well as their widespread cultivation in the Indian subcontinent.

Pigeonpea

Pigeonpea is commonly known in India as *arhar, tur,* or Red gram. Though over 90 per cent of the world pigeonpea is produced in India (1.8 million tons), there are as many as 58 other countries in the world where pigeonpea is grown. While in the Indian subcontinent it is used mostly as *dal,* it is consumed as cooked whole dry or green seed in eastern Africa, and mainly as cooked green seed in Central America. Only in the Indian subcontinent and eastern Africa (Kenya, Uganda, Tanzania, Zambia and Malawi) large acreages of pigeonpea are seen; in other countries it is grown mostly as a backyard crop.



Pigeonpea wilt is a serious problem. ICRISAT pathologists have identified several wilt-resistant lines 'ICP-8863' standing in comparison to the susceptible line 'ICP-2376'

Pigeonpea is a perennial shrub with woody stems and branches. Traditional cultivars have a short day photoperiod response—they will flower only when days are shorter; thus their use is highly seasonal. While in India it is cultivated as an annual crop, in many other countries it is grown as a perennial and pods are harvested at regular intervals.

Country research programmes such as the All-India Co-ordinated Pulse Improvement Project (AICPIP) are carrying out research on pigeonpea relevant to the requirements of their countries. The Consultative Group for International Agri-

*Leader, Pulses Improvement Program and Chickpea Breeder, respectively cultural Research (CGIAR) established in India the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in 1972 to serve as the world center to improve genetic potential for grain yield and nutritional quality of pigeonpea and chickpea (gram) along with three other crops. ICRISAT has been supporting the pigeonpea research programs in India, Kenya, Malawi, Trinidad, Panama, etc. for the last few years by sharing its vast collection of germplasm (over 8,000 accessions) as well as the breeding materials generated at ICRISAT Center.

Pigeonpea research in all countries is directed towards increase in yield with stability in performance from one year to another. However, pigeonpea has to fit in with the cropping system in each country. India needs cultivars which are of short (less than 150 days), medium (150-180 days), as well as long duration (more than 180 days). Cultivars should fit in with other crops such as sorghum or maize as an intercrop or should do well as sole crop. There is a need of cultivars for the rabi season. Cultivars should carry resistance to the three major diseases namely, wilt, sterility mosaic, and Phytophthora blight as well as to pests, particularly pod borer and pod fly. There is also a need for tolerance to waterlogging, drought, and salinity. Most of the pigeonpeas are grown as a no input or low input crop, that is, very little or no fertilizer, irrigation, and insecticides. However, there is a need to identify cultivars which are responsive to high inputs. ICRISAT scientists have addressed themselves to these problems and a good deal of breeding material with superior traits from the viewpoint of yield and stability have been supplied to the breeders, agronomists, pathologists, and entomologists located at various research centres in India. The technology of producing pigeonpea hybrids has been developed by ICRISAT and is available. ICRISAT has in its pipeline several promising lines which in the near future should appear on the Indian scene.

In countries where labour is costly, mechanized cultivation is required. For mechanical harvesting it is necessary to develop short (height as well as duration) cultivars with synchronous maturity. Through an ICRISAT supported programme, scientists at the University of Queensland in Australia have identified pigeonpea lines which mature in a fixed time irrespective of the duration of daylength (photoperiod insensitive) and are suitable for mechanical harvesting. These lines will be useful in countries such as Australia, Trinidad, Puerto Rico, etc. ICRISAT has developed a few lines which are of vegetable types and these have been found very promising in central America.

Chickpea

Chickpea is known in India as *Chana* or Bengal gram. India produces more than 70 per cent (5.4 million tonnes) of world chickpeas. However, chickpea is widely grown in western Asia, in countries around the Mediterranean, and in eastern Africa. Some chickpea is grown in the Americas, particularly in Mexico. There are two types of chickpea, the *desi* characterized by small size and coloured seed coat and the *kabuli* by large size and white seed coat. Countries in the Indian subcontinent (India, Pakistan, Bangladesh and Burma) and in eastern Africa (Ethiopia and Sudan) grow mostly the *desi* type. Afghanistan and Iran grow both *desi* and *kabuli* types, but all other countries grow only *kabuli* types. In India, chickpea seed is consumed whole after cooking or as *dal.* In other countries the seed is cooked whole for consumption or in the Arab world, a preparation called *Hommos* is very popular. In Spain, roasted chickpeas, as are eaten in India, are seen in the market.

Chickpea has evolved under rather harsh environments and most of the traditional types do not respond to high inputs; in fact application of water and fertilizers leads to excessive vegetative growth and poor yields in many regions. It is generally grown in cool, dry periods on receding soil moisture.

As in the case of pigeonpea, country research programmes (for example AICPIP) are actively engaged in research on chickpea. This crop, as pointed out before, has been included in the mandate of ICRISAT. In addition, to cater to the needs of chickpea research in dry regions of the world, chickpea was included in the mandate of the International Center for Agricultural Research in the Dry Areas (ICARDA) in Syria by the CGIAR. To avoid duplication of work, ICRISAT and ICARDA drew up agreement to work jointly on this crop. ICRISAT scientists located in India work mainly on the *desi* types and ICRISAT scientists located at ICARDA work on *kabuli* types. ICRISAT and ICARDA together are assisting many national programs, including the AICPIP, by sharing their germplasm collection (over 11,000 accessions) and breeding materials.

Again like pigeonpea, research on chickpea is directed towards high yields and stability in performance over years. In India, some of the specific needs are resistance to diseases (mainly wilt and root rots) resistance to pests (particularly the pod borer) tolerance to cold, drought and soil salinity, and response to irrigation and phosphatic fertilizers. ICRISAT scientists have identified many lines with resistance to several of the stress factors mentioned above and have freely shared these materials, both germplasm and breeding lines, with scientists located at various centres of the AICPIP as well as as other countries. In West Asia it has been found by ICARDA and ICRISAT scientists that in comparison to the traditional spring crop, the winter crop can give much higher yield provided it has resistance to a very serious disease, the *Ascochyta* blight. Work done at

ICARDA has helped in identifying several blight resistant lines and on farm demonstrations of these disease resistant lines have been successful in Syria. There are strong indications that this work may revolutionize chickpea production in west Asia. The blight resistant lines developed by ICRISAT/ICARDA have been made available to Pakistan where over 70 per cent of the chickpea crop was destroyed by the disease during 1978-79 and 1979-80 seasons. In countries where labour is expensive, tall and erect chickpeas are required for mechanical harvesting. Such lines are being developed and are in an advanced stage of testing.

Lentil

Though India has about 47 percent (0.93 million ha) of the world area under lentil, it contributes only about 35 per cent (0.43 million tonnes) to the world production. Lentil is widely grown in areas where chickpea is raised as both these crops require similar agroclimate. Countries which produce significant amounts of lentil are Bangladesh, India, Pakistan in the Indian subcontinent; Syria and Turkey in western Asia; Ethiopia in Africa; Spain in Europe; and Argentina, Canada, and the USA in the Americas. There are two types of lentil, large seeded with yellow cotyledons and small seeded with pink cotyledons. The large seeded is more common around the Mediterranean and in the Americas, whereas the small seeded one is more common in the Indian subcontinent and western Asia. Lentil is cooked whole or as *dal* and lentil soup is popular in many countries.

There is evidence to indicate that lentil responds to inputs a little better than chickpea. Phosphate application and adequate moisture give better yields. Again as in the case of pigeonpea and chickpea, country research programme (for example, AICPIP, U.S. Department of Agriculture, Department of Agriculture in Turkey, Bangladesh Agricultural Research Council, etc.) have been active in carrying out research on lentil. To support country efforts, lentil was included in the mandate of ICARDA, which has already developed a cooperative network with several national programmes. ICARDA has already built a collection of around 5,000 germplasm accessions of lentil from all over the world.

As in the case of other crops, the major objective of research on lentil is to develop genotypes which give assured high yields. Research efforts around the world include work on (i) resistance to diseases such as wilt and root rots, rust, Ascochyta blight, downy mildew, and several viruses. (ii) resistance to pests, particularly pod borers, aphids and weevils, (iii) tolerance to salinity, drought, cold and zinc and iron deficiencies, (iv) response to phosphorus application and irrigations, (v) resistance to shattering of seed and (vi) improving harvest index which is normally around 30 per cent only. Indian scientists, particularly at Pantnagar and Jabalpur have done commendable work in identifying resistance to diseases such as wilt, root rot, and rust. Lines resistant to pod borers and aphids have been identified. Small flowers of lentil create problems in making crosses, but breeders have refined the techniques and rapid progress is now being made in the breeding programmes. ICARDA already sharing the breeding material with many national programmes through its regional and international co-operative yield trials.

Special reference needs to be made to the microbiological aspects. Legumes have the advantage of getting nitrogen from the atmosphere through nitrogen-fixing bacteria. Though much has been said about the progress made in identifying more efficient strains of bacteria, intensification of efforts is a must. We feel yet better strains need to be identified and technology worked out. In the pulse crops referred in this article, we have a long way to go before strains as efficient as those identified for soybeans become available.

On one hand pulses provide protein but on the other some of them contain antinutritional factors. Research has now begun and in the years to come, not only we should know more about such factors, but hopefully we will have identified genotypes which contain least or no amount of antinutritional factors.

Very frequently comments are made that while there has been a 'green revolution' in wheat, rice and some other cereals, no such revolution has occurred in pulses. For several reasons it is unfair to compare legumes with cereals. Comparisons are really only appropriate between legumes. Progress in soybean has been striking and the aim of all pulse workers should be to improve pulses and bring them at par with soybeans. The world average production of pulses is about 700 kg/ha and that of soybeans about 1,500 kg. Genotypes which yield more than 2500 kg/ha are already available but their stability is not fully satisfactory. Once that is achieved, it should be possible to raise pulse production to the level of soybeans and we will have already more than doubled the world production.