

New "super early" chickpeas

*Mature early, escape biotic and abiotic stresses,
and have large seeds*



Farmers of Nandyal in Kurnool Dist. of Andhra Pradesh with a bumper harvest of desi chickpea variety JG 11 (ICCV 93954).



About ICRISAT



Science with a human face

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is a non-profit, non-political organization that does innovative agricultural research and capacity building for sustainable development with a wide array of partners across the globe. ICRISAT's mission is to help empower 644 million poor people to overcome hunger, poverty and a degraded environment in the dry tropics through better agriculture. ICRISAT belongs to the Alliance of Centers of the Consultative Group on International Agricultural Research (CGIAR).

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Introduction

Chickpea [*Cicer arietinum*], a normally cold season legume, is grown in over fifty countries in a wide range of environments and cropping systems. An important component to be considered for crop adaptation to the different environments is phenology (the time to flowering, podding and maturity). Chickpea can mature in a wide timeframe ranging from 80 to 180 days depending on the genotype, growing conditions and environments. However, in at least two-thirds of the chickpea growing areas, the available crop-growing season is short (90-120 days) due to risk of drought or temperature extremities towards the end of the crop season, which coincides with the pod filling stage of the crop. Therefore, to enable the crop to escape stress at the end of the season, it is important to cultivate early maturing varieties for these areas.

Chickpea is largely grown on receding soil moisture after the rains. Terminal drought and heat stresses are the major abiotic constraints it faces in the semi-arid tropics, where it is grown in rainfed conditions (ie, irrigated only when it rains). Terminal drought is also a major constraint in autumn-sown rainfed crops in Mediterranean-type environments (as in Australia). Early maturity is also important for the summer-grown crop in temperate environments (as in Canada) as the crop often encounters end of season frost.



Scientists examining a chickpea crop in Ethiopia.

India is the largest chickpea growing country in the world with over 60% share in the chickpea area. During the past four decades, the chickpea area declined by 3.2 m ha in northern India (cooler long-season environments) and increased by 2.5 m ha in central and southern India (warmer short-season environments), thus further necessitating cultivation of early maturing varieties. The chickpea area under late sown conditions is increasing in many chickpea growing areas, particularly in northern India due to increase in cropping intensity and late harvesting of the preceding crop. Other areas that could be used for chickpea cultivation are those that remain fallow in the winter season after harvest of rainy season rice (about 14.0 m ha in South Asia). Early maturing varieties would be needed in all these late sown conditions.

ICRISAT's efforts

Chickpea is one of ICRISAT's mandate crops, and development of early maturing varieties is one of the major objectives of ICRISAT's chickpea breeding program. ICRISAT and the national agricultural research system (NARS) partners developed many early maturing, high yielding and fusarium wilt resistant varieties of desi and kabuli chickpea. Adoption of these varieties has led to increase in area and productivity of chickpea in short-season environments, for example, in central and southern India and in Myanmar. The first landmark variety was ICCV 2, which is perhaps the world's earliest maturing variety of kabuli chickpea. It flowers in



Myanmar farmers harvesting "a sea of golden chickpea".

about 30 days and matures in about 85 days at Patancheru near Hyderabad. It has been released for commercial cultivation in India, Myanmar and Sudan, and has spread to other countries, including Tanzania. It has been instrumental in extending kabuli chickpea cultivation to tropical environments, and presently covers over 50% of the chickpea area in Myanmar.

Pursuing the super-early chickpea

ICRISAT scientists made further advancements in breeding for earliness in chickpea. They developed two super-early desi varieties, ICCV 96029 and ICCV 96030, which mature in 75 to 80 days in southern India. These lines provided further opportunities for expansion of chickpea cultivation in new niches. Scientists conducted several experiments on super-early lines to see if these were suitable for cultivation in northern India for use as a vegetable (immature green peas). The farmers, especially marginal farmers, prefer to grow early podding cultivars as a vegetable as early delivery to the market fetches a higher price. Experiments showed that super-early chickpeas could be grown after harvest of rice and before planting of wheat as a short duration catch crop for use as a vegetable. This short duration crop will provide extra income to farmers and the inclusion of a legume (chickpea) in a rice-wheat system will have beneficial effects on productivity and long-term sustainability of the cropping system. However, the currently available super-early lines, particularly ICCV 96029,

need improvement for seed size and resistance to fusarium wilt, so scientists are focusing current breeding efforts on improvement of these traits.

Efforts have also been made to identify new sources of earliness. It was found that the major early flowering gene present in ICCV 2 (also in ICCV 96029) was different from that present in ICC 5810 (Harigantars). A new early flowering gene was identified from ICC 16641 and ICC 16644. Thus, three major genes were identified for early flowering. These discoveries will improve precision and efficiency of chickpea breeding for desired maturity.

ICRISAT has succeeded in improving fusarium wilt resistance and seed size of super-early lines. Progenies have been developed that are as early as the super-early parent ICCV 96029 and have a high level of resistance to fusarium wilt, with a seed size similar to that of ICCV 2. There are several other lines that mature even a week earlier than ICCV 96029, which look very promising to scientists on the super-early mission.

Farmers, especially in the short-season areas, can now be assured of super-early chickpeas with acceptable seed size and resistance to fusarium wilt in the not too distant future.



An Indian farmer carrying away a load of harvested chickpea.



Green chickpea, a favorite snack in Indian towns, being sold from a pushcart.