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Farmers participatory introduction and expansion of chickpea in the rainfed rice fallow lands in India

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India imports approximately 3.5 million tonnes of pulses every year to meet its domestic consumption. It is most unlikely that irrigated area will be available for pulses cultivation in future. However, about 11.7 million ha remains fallow during the *rabi* (post-rainy season) after harvest of *kharif* (rainy season) rice in the states of Bihar, Chhattisgarh, Madhya Pradesh, Maharashtra, Jharkhand, Orissa, Uttar Pradesh, Uttaranchal and West Bengal etc. Nearly 80% of the *kharif* rice area (5.6 m ha) remains fallow in *'rabi'* in the states of Madhya Pradesh and Chhattisgarh alone. The GIS analysis of the rainfed rice fallow lands (RRFL) has indicated that they represent diverse soil types and climatic conditions. Available moisture holding capacity (1 m soil profile) for most of these RRFL ranges from 150-200 mm. The soils in at least 30% (3.5 million ha) of these RRFL are fully saturated during most of the rice growing season, thus the residual moisture left in these soils at the time

of rice harvest offer a huge potential niche for chickpea cultivation (Subbarao *et al.*, 2001). The R&D evidences revealed that following improved agronomy, chickpea (*Cicer arietinum* L.) can be grown profitably on the moisture left by rice. This paper discusses the opportunities of the farmers' participatory introduction and expansion of improved agronomy for sustainable production of chickpea in the RRFL of India.

METHODOLOGY

The prospects of chickpea cultivation in RRFL have recently been reviewed (Pande, 2007). Participatory rural appraisal and base-line surveys conducted to identify and prioritize constraints and opportunities for introducing chickpea in the RRFL and for selection of sites and farmers. Improved crop production technologies, such as early maturing cultivars of rice and chickpea, seed priming, seed treatment with fungicides and insecticides, application of *Rhizobium*, PSB, DAP; and pheromone traps and insecticides for IPM of pod borer were packaged as improved pulse production and protection technology (IPPPT) to promote chickpeain RRFLs in Chhattisgarh and Madhya Pradesh from 2008-09 to 2011-12 post rainy crop season. The four major farmers participatory and scientists led interventions were (1) participatory variety selection, (2) IPPPT- demonstrations, (3) village level seed system (VLSS), and (4) capacity building in introduction and expansion of chickpea in the RRFL.

RESULTS

Selection of early rice and chickpea cultivars: Productivity of early duration rice varieties/hybrid (PS 3, JRH 5 and MTU 1010) suitable for rice-chickpea cropping system in the RRFL was > 4 t/ha, and 72-150% than long duration traditional rice cultivar(s) grown by farmers. Out of 16 wilt resistant and high yielding varieties of chickpea, three chickpea varieties (JG 11, JG 74 and JG 14) performed consistently superior (>1 t/ha) and selected by farmers to be sown after rice in RRFL.

IPPPT-demonstrations: A total of 6313 IPPPT demonstrations (Chhattisgarh: 2893 and Madhya Pradesh: 3420) were successfully established in each of the participating farmers' fields from 2008-09 to 2011-12 crop seasons. All IPPPT demonstrations were established in 0.40 ha/farmer (@ 60 kg seed/ha). Chickpea sowing were initiated soon after harvest of rice using local practices and or zero-tillage. The mean yield of improved chickpea cultivars ranged between 0.87 t/ha and 1.40 t/ha across farmers, villages and years in Chhattisgarh and Madhya Pradesh.

Village level seed system (VLSS): As most of the farmers in the RRFL do not have any access to seeds of improved varieties of chickpea. Therefore along with on-farm demonstrations of IPPPT-chickpea, attempts were made to develop an individual household and village level seed system for chickpea. Farmers, who have life-saving irrigation facility, were selected for VLSS. All the VLSS farmers were trained in chickpea production and storage. Total seed produced and stored from VLSS was 215.28 t in Chhattisgarh and Madhya Pradesh from 2008-09 to 2011-12 crop seasons.

Benefit–cost ratio: The IPPPT package developed and demonstrated in participation with farmers to introduce and expand chickpea in RRFL of Chhattisgarh and Madhya Pradesh was highly profitable and cost-effective. The benefit- cost ratio of chickpea production using IPPPT was estimated to be 1.87 to 3.50 in Madhya Pradesh and 1.31 to 4.87 in Chhattisgarh.

Chickpea area expansion: Several farmers at their own initiative expanded IPPPT-chickpea by cultivating their entire RRFL. For example Mr. Rakesh Dixit from Bahuribandh village, Rewa district, Madhya Pradesh expanded IPPPT-chickpea from 1 acre to 26 acres during the project period. In general chickpea production and productivity increased 2-3 folds from 2008-09 to 2011-12 in the project districts of Chhattisgarh and Madhya Pradesh following IPPPT-chickpea project interventions.

CONCLUSION

The RRFL offer some of the most productive environments for chickpea; if suitably integrated into rainfed rice production systems, this can revolutionize chickpea production, and thus enhance the per capita availability of pulses in India. Adequate policy support from the Government is necessary for strengthening researchers led farmers participatory extension along with timely availability of necessary inputs needed for growing chickpea in RRFL.

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