

Increased Chickpea Yield and Economic Benefits by Improved Crop Production Technology in Rainfed Areas of Kurnool District of Andhra Pradesh, India

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Chickpea, *Cicer arietinum* L., is a drought tolerant leguminous crop used in various foods in several developing countries, particularly in India as a source of dietary protein. There is a big gap between the yield realized in experimental station (2200 kg ha⁻¹) and the farm yield (1274 kg ha⁻¹) in Andhra Pradesh. The major constraints responsible for this untapped yield potential are inappropriate production practices, viz, usage of low yielding and non-responsive genotypes, pest and disease problems, lack of stress-resistant high-yielding genotypes, lack of improved soil and crop management practices and lack of appropriate institutional support.

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and the Government of Andhra Pradesh have initiated the Andhra Pradesh Rural Livelihood Project (APRLP) to help reduce rural poverty by increasing agricultural productivity and improving livelihood opportunities through technical backstopping and convergence through a consortium of institutions. Watersheds were used as an entry point for research and development activities.

Nandavaram and Jillella villages of Banaganapalle mandal in Kurnool district of Andhra Pradesh were selected for undertaking on-farm research. Systematically collected soil samples from thirty farmers' fields in Nandavaram and Jillella watersheds on a toposequence were analyzed for physical and biological parameters and various nutrients. The soil analysis indicated that the fields in the two watersheds were low in N (496 and 333 mg kg⁻¹ soil), low to medium in available P (5.71 and 2.72 mg kg⁻¹ soil) (Olsen's P), high in exchangeable K (223 and 178 mg kg⁻¹ soil), and low in available Zn (0.39 and 0.24 mg kg⁻¹ soil), S (7.52 and 4.09 mg kg⁻¹ soil) and B (0.5 and 0.45 mg kg⁻¹ soil). This critical information aided in identifying better options to improve the chickpea yield levels and for sustaining natural resources.

Table 1. Yield and economics of chickpea in on-farm trials, Nandavaram and Jillella watersheds, Kurnool district, Andhra Pradesh, post-rainy season 2002 and 2003.

Cultivation method	Grain yield (t ha ⁻¹)			Cost of cultivation (Rs ha ⁻¹)			Net return (Rs ha ⁻¹)			Benefit Cost Ratio		
	2002	2003	Pooled	2002	2003	Pooled	2002	2003	Pooled	2002	2003	Mean
Improved Production technology	2.13	2.03	2.09	8311 (US\$185)	8200 (US\$182)	8271 (US\$184)	23598 (US\$524)	24330 (US\$541)	23862 (US\$530)	2.8	3.0	2.9
Farmers' practice	1.42	1.29	1.37	5792 (US\$129)	5706 (US\$127)	5761 (US\$128)	15450 (US\$343)	14996 (US\$333)	15287 (US\$340)	2.7	2.6	2.7
SE ±	0.06	0.05	0.04	14	19	12	924	836	666			
CV %	14.0	9.6	12.8	0.9	0.7	0.8	18.9	12.8	17			
LSD(5%)	0.19	0.17	0.13	43	62	34	2786	2726	1949			

Table 2. Yield components of chickpea in on-farm trials, Nandavaram and Jillella watersheds, Kurnool district, Andhra Pradesh, postrainy season 2002 and 2003.

Cultivation method	Total dry matter (t ha ⁻¹)			100 grain weight (g)			Harvest Index		
	2002	2003	Pooled	2002	2003	Pooled	2002	2003	Pooled
Improved Production technology	3.76	3.85	3.80	18.93	19.41	19.10	0.57	0.53	0.55
Farmers' practice	2.83	2.74	2.80	17.22	17.74	17.41	0.50	0.47	0.49
SE ±	0.12	0.08	0.08	0.34	0.34	0.25	0.01	0.01	0.01
CV %	14.6	7.5	12.6	7.5	5.4	6.8	8.9	8.0	8.6
LSD(5%)	0.36	0.27	0.24	1.02	1.10	0.73	0.04	0.04	0.03

Sixteen on-farm trials in 2002 and nine trials in 2003 were conducted during the postrainy season with the objective to demonstrate the beneficial effects of improved production technologies over farmers practice. Improved production technology was compared with the farmers' method in an area of 1000 m² in each of the farmers' fields. The improved technology package included improved cultivar (ICCC 37), a seed rate of 60 kg ha⁻¹, seed treatment with thiram (3 g kg⁻¹ seed), inoculation with *rhizobium*, a fertilizer dose of 20 kg N and 50 kg P₂O₅ ha⁻¹, basal application of micro-nutrient mixture of 5 kg borax (0.5 kg B ha⁻¹), 50 kg zinc sulphate (10 kg Zn ha⁻¹) and 200 kg gypsum (30 kg S ha⁻¹) per hectare together with need-based pest and disease control measures. Two inter-cultivations at 25 and 50 days after sowing to control weeds was taken up. One insecticide spray was given at pod formation stage to control pod borers. The farmers' method included a local variety, a seed rate of 50 kg ha⁻¹ and a fertilizer dose of 14 kg N and 35 kg P₂O₅ ha⁻¹. Entire dose of N and P was applied as basal. The amount of rainfall from June to December was 708 mm during 2002 and 504 mm during 2003. The data was analyzed separately for both years considering farmers as replications using one-way ANOVA with randomized blocks on GenStat. Subsequently, pooled analysis of two year's data was carried out using two-way ANOVA. The analysis of variance indicated that management practices (improved crop production technology and farmers practice) differed significantly in both years (P=<0.001–0.008), as well as in the combined analysis (P=<0.001). The year and year x management were non-significant (data not given).

The improved production technology gave higher grain yields and recorded a mean yield of 2.09 t ha⁻¹ which was 53% higher than that obtained with farmers' practice yields of 1.37 t ha⁻¹ (Table 1). The increased grain yield with improved production technology was

mainly because of increased total dry matter, higher 100-grain weight and harvest index (Table 2). Yield increase in response to fertilizer recommendations was also reported by Tamboli et al. (1996).

The economic viability of improved technology over the traditional farmers' practice was calculated depending on prevailing prices of input and output costs. The additional cost of US\$56 ha⁻¹ (Table 1) incurred in the improved technology as compared to farmers practice was mainly due to balanced fertilization (micro-nutrients and additional N and P), additional seed cost, seed treatment, IPM and one additional inter-cultivation. However, the improved technology resulted in increased mean income of US\$190 with a cost-benefit ratio of 2.9 (Table 1). This additional income could substantially benefit the resource poor farmers and improve their livelihoods in the dry regions of Kurnool district of Andhra Pradesh. Thiyagarajan et al. (2003) reported that the use of sulphur and micronutrients (Zn, B, Mo and Fe) improved productivity of pulse crops considerably. Balanced nutrition is indispensable for achieving higher productivity. Sachdev et al. (1992) obtained increased grain yield and harvest index of chickpea due to balanced fertilization. Shinde and Mane (1996) reported that the balanced application of fertilizers based on soil testing improved the yield of chickpea by 47 percent and monetary returns by Rs 7676 (US\$171) per hectare over control. The results from the current study clearly brought out the potential of improved production technology in enhancing chickpea production and economic gains in the dry ecoregions of Andhra Pradesh.

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