# Effect of Improved Crop Production Technology on Pigeonpea Yield in Resource Poor Rainfed Areas

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Pigeonpea (*Cajanus cajan* (L.) Millspaugh) is a deep-rooted and drought-tolerant (Troedson et al. 1990) leguminous food crop used in several countries particularly in India as a source of dietary protein. India accounts for about 80% of the total world pigeonpea production. It is one of the principal dryland crops in Andhra Pradesh with a very low productivity (450 kg $ha^{-1}$). The production is constrained by the use of less productive land, water logging or dry spells during critical stages of crop growth, pest and disease problems, and lack of drought-resistant, high-yielding genotypes, and appropriate agronomic management.

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and the Government of Andhra Pradesh have initiated the Andhra Pradesh Rural Livelihoods Project (APRLP) in the drought prone districts of Andhra Pradesh state of India, viz, Kurnool, Mahabubnagar, Nalgonda, Anantpur and Prakasam, to help reduce poverty by increased agricultural productivity and improved livelihood opportunities through technical backstopping and convergence through a consortium of institutions. Watersheds are used as an entry point for these activities.

Nandavaram village of Banaganapalle mandal in Kurnool district was selected as a representative watershed site based on the extent of rainfed area in the district, current crop productivity, and willingness of the community to participate in the on-farm research activities. Systematically collected soil samples from thirty farmers' fields in the Nandavaram watershed on a toposequence were analyzed for physical and biological parameters and various nutrients. The soil analysis indicated that all the fields are low in N (496 mg $kg^{-1}$ soil), low to medium in available P (5.71 mg $kg^{-1}$ soil)(Olsen's P), high in exchangeable K (223 mg $kg^{-1}$ soil), and low in available Zn (0.39 mg $kg^{-1}$ soil), S (7.52 mg $kg^{-1}$ soil) and B (0.5 mg $kg^{-1}$ soil). The information from soil analysis along with historical rainfall, and minimum and maximum temperature data enabled to calculate the length of growing period (LGP). This critical information assisted in identifying better options for pigeonpea cultivation to improve the productivity levels and for sustaining the natural resources.

Twelve on-farm trials were conducted during the 2002/03 rainy season with the objective to demonstrate the effect of improved production technologies over farmers' practice. Improved production technology was compared with the farmers' method in an area of 1000 $m^2$ in each of the farmers' fields. The improved technology package included medium duration high-yielding variety (ICPL 87119) resistant to fusarium wilt and sterility mosaic diseases; a seed rate of 12 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 $P_2O_5$ $ha^{-1}$; 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 appropriate need-based pest and disease control measures. Two inter-cultivations at 25 and 50 days after sowing to control weeds were taken up. One insecticide spray was given at pod formation stage to control pod borers. The farmers' method included a seed rate of 10 kg $ha^{-1}$ and a fertilizer dose of 12 kg N and 30 kg $P_2O_5$ $ha^{-1}$. Entire dose of N and P was applied as basal. The seasonal

**Table 1. Yield and economics of pigeonpea in on-farm trials (average of 12 trials), Nandavaram nucleus watershed, Kurnool district, Andhra Pradesh, rainy season 2002.**

| Cultivation method | Grain yield (t $ha^{-1}$) | Stalk yield (t $ha^{-1}$) | Cost of cultivation (Rs $ha^{-1}$) | Net return (Rs $ha^{-1}$) | Benefit cost ratio |
|---|---|---|---|---|---|
| Improved production technology | 1.61 | 2.93 | 6838 (US$152) | 16476 (US$366) | 2.4 |
| Farmers' practice | 0.53 | 1.10 | 4260 (US$95) | 3437 (US$76) | 0.8 |
| SE ± | 0.096 | 0.202 | 14.2 | 1393.8 | |
| CV% | 31.2 | 34.7 | 0.9 | 48.5 | |
| LSD (5%) | 0.30 | 0.63 | 44.3 | 4338.3 | |

**Table 2. Yield components of pigeonpea in on-farm trials (average of 12 trials), Nandavaram nucleus watershed, Kurnool district, Andhra Pradesh, rainy season 2002.**

| Cultivation method | Total dry matter ($t\ ha^{-1}$) | Pod weight ($t\ ha^{-1}$) | Shelling (%) | 100 grain weight (g) | Harvest index |
|---|---|---|---|---|---|
| Improved production technology | 5.26 | 2.33 | 69.1 | 10.3 | 0.31 |
| Farmers' practice | 1.92 | 0.82 | 65.6 | 9.0 | 0.28 |
| SE ± | 0.321 | 0.132 | 0.93 | 0.31 | 0.009 |
| CV% | 31.0 | 29.0 | 4.8 | 11.1 | 10.3 |
| LSD (5%) | 1.00 | 0.41 | 2.89 | 0.96 | 0.027 |

rainfall was 695 mm. The data was analyzed considering farmers as replications using analysis of variance (ANOVA) with randomized blocks on GENSTAT. ANOVA indicated that management practices (improved crop production technology and farmers practice) differed significantly for all the parameters presented in Tables 1 and 2.

The improved production technologies gave higher yields and recorded a mean grain yield of 1.61 $t\ ha^{-1}$ which was 204% higher than that obtained with the farmers' practice yields of 0.53 $t\ ha^{-1}$ (Table 1). In addition to increased grain yields, improved technology also resulted in higher stalk yield of 2.93 $t\ ha^{-1}$ compared to 1.10 $t\ ha^{-1}$ of farmers' practice. The increased grain and stalk yields with improved production practice were mainly because of increased total dry matter, increased pod weight, higher shelling percentage, higher 100-grain weight and harvest index (Table 2). Yield increase in response to recommended fertilizers and rhizobium inoculation were also reported by Jain et al. (1988).

The economic viability of improved technology over the farmers' practice was calculated depending on prevailing prices of inputs and outputs. The additional cost of US$57 $ha^{-1}$ (Table 1) incurred due to 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 an increased mean income of US$290 with a cost-benefit ratio of 2.4 (Table 1). This additional income could substantially benefit the resource poor farmers and improve their livelihoods in the dry regions of the district. Puste and Jana (1995) reported that the yield attributes and seed yield of pigeonpea varieties were significantly influenced by phosphorus and zinc application with a maximum benefit-cost ratio of 4.12. Yadav et al. (1997) reported that with the application of 100% recommended fertilizer, sole pigeonpea gave a grain yield of 2.12 $t\ ha^{-1}$ with net returns of Rs 12,491 per hectare and a benefit-cost ratio of 2.94. The results from the current study indicate the potential benefits of improved production technology in enhancing pigeonpea yields and net returns in the dry regions of Andhra Pradesh.

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