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Short communication

Influence of nutrient source on yield, quality and economics of seed production in vegetable cowpea (*Vigna unguiculata* ssp. *sesquipedalis*)

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ABSTRACT

Field investigation was carried out to study the influence of different sources of nutrients on seed production in vegetable cowpea *(Vigna unguiculata* ssp. *sesquipedalis)* during 2010-11 in Randomized Block Design, with twelve combinations of nutrient sources. Results showed significant variation in seed yield potential in the crop. Highest seed yield (435.97kg ha^{-1}) was recorded in the treatment where recommended NPK dose for the seed crop was applied along with vermicompost at 50 per cent nitrogen substitution. Yield attributes were found non-significant, but had a positive influence on seed yield. Germination percentage and 100-seed weight was significantly higher in treatments receiving a combination of vermicompost and poultry manure. Benefit:Cost analysis revealed that 50 per cent N substitution with vermicompost and 25% N with poultry manure were the most profitable in cowpea seed production.

Key words: Economics, integrated, nitrogen, quality seed, vermicompost

Cowpea (*Vigna unguiculata* ssp**.** *sesquipedalis)* is one of the most popularly grown vegetable crops in Southern Kerala on account of its high yield and market preference. Local varieties predominate in the market, but recent trends show a shift towards preference for improved and newer varieties released from various research institutions. Non-availability of quality seeds in adequate quantity and in time has hampered adoption of improved varieties. Quality seed is a pre-requisite in crop production, as, nearly 25 per cent of the yield realized in the crop is decided by quality of the seed material used (KAU, 1991). Conjunctive use of good quality seeds with inputs like water, fertilizer and plant protection chemicals can help tap the superior genetic potential of high-yielding varieties and accrue benefit to the farmer (Kannaiyan, 2005). It is in this background that an experiment was envisaged with an objective of exploring the influence of various nutrient sources on seed production in vegetable cowpea and assessing the economics of integrating different nutrient sources.

The experiment was laid out in Kollam district, Kerala ($9^0$16'N latitude, $76^0$37'E longitude, 91.44m above MSL) during October 2010 - January 2011 in Randomized Block Design, with 12 treatments replicated thrice, involving different nutrient sources. 'Vellyani Jyothika' variety released from Kerala Agricultural University was used in the study. This variety is characterized by long, light-green pods with seeds tinged cream and red. The soil was ultisol lateritic with 0.65% organic carbon, and, 257.15, 7.89 and 45.75kg ha^{-1} available N, P and K, respectively. Recommended dose (RD) of NPK for cowpea seed crop (25:30:12.5kg ha^{-1}) was adopted as per KAU, 2007. The experiment constituted twelve treatments, viz., T_1 - 100% RD as chemicals; T_2 - 25% RD N and K as foliar spray; T_3 - 50% of RD N and K as foliar spray; T_4 - 25% N as vermicompost; T_5 - 25% RD N as poultry manure; T_6 - 25% RD N as vermicompost + poultry manure; T_7 - 50% RD N as vermicompost; T_8 - 50% RD N as poultry manure; T_9 - 50% RD N as vermicompost + poultry manure; T_{10} - 100% RD with organic sources; T_{11} - 150% RD as chemical fertilizers; T_{12} - 150% RD with organic sources. Chemical and organic manures were applied (alone, or in combinations as per treatments) in three splits: basal, one month after planting, and after the first harvest. Full dose of phosphorus was applied at the time of sowing. The first two harvests were made for use of cowpea as vegetable, and thereafter, the fruits were left on the plant for maturation. Four pickings of mature pods were undertaken for seed extraction, and, the last-formed fruits were harvested as vegetable. Mature pods were dried in the open, avoiding peak sunshine hours during noon. Seeds were extracted and dried to safe a moisture level (5-7%) in a seed drier and observations were made on germination percentage, 100-seed weight and vigour index. The observations recorded were analyzed statistically for variation among treatments as per Gomez and Gomez (1983). Cost of cultivation and returns were worked out to compute Benefit:Cost ratio for comparison between treatments.

Data on fruit yield, yield attributes and seed yield in cow pea fertilized with various combinations of nutrient sources are presented in Table 1. Data revealed that influence of the nutrient source on vegetable and mature pod yield, and pod characters, were not significant; but, the effect on seed yield was significant. Seed yield was significantly higher when vermicompost was used for 50 per cent N substitution (435.97kg ha^{-1}), which was on par with full organics (421.75 and 409.33kg ha^{-1}) and 25 per cent substitution with poultry manure (413.38kg ha^{-1}). Vegetable yield and mature pod yield also followed a similar trend as seed yield, confirming the response to integration of sources. It was also observed that inclusion of organic manures significantly improved seed yield in cow pea. However, substitution level varied with type of manure used. In the treatment concerning integrated application, chemical fertilizers may have supplied initial nutrient requirement, and, the organic sources would have supplied the nutrients at seed maturation stages. Increased availability of nutrients to plants with application of organics may have even enhanced the efficiency of the N and P applied. Keiko *et al* (1997) reported efficiency of inorganic manures applied as more pronounced when combined with organic fertilizers. Similar results were reported by Pandey *et al* (1980) in okra, Chavan *et al* (1997) and Suagundi (2000) in chilli and Rekha and Gopalakrishnan (2001) in bitter gourd.

Table 1. Influence of nutrient source on yields and pod characters in cowpea

Treatment	Vegetable yield (kg ha^{-1})	Mature pod yield (kg ha^{-1})	Pod length (cm)	Pod girth (cm)	Pod weight (g)
T_1 100% RD as chemical fertilizer	187.92	594.00	30.53	2.60	6.71
T_2 25% RDN & K - foliar	199.00	580.25	31.33	2.30	7.87
T_3 50% RDN & K - foliar	239.98	627.00	32.40	2.10	6.83
T_4 25% RDN as VC	206.58	466.58	30.60	2.23	7.28
T_5 25% RDN as PM	242.92	781.00	28.67	1.80	9.72
T_6 25% RDN as VC+PM	172.33	668.25	29.87	1.53	7.49
T_7 50% RDN as VC	203.50	800.25	32.83	1.68	7.51
T_8 50% RDN as PM	160.42	550.00	30.50	1.63	5.85
T_9 50% RDN as VC+PM	214.67	577.13	32.73	1.67	5.62
T_{10} 100% RD as OM	196.00	671.00	32.07	1.63	7.31
T_{11} 150% RD as chemical fertilizer	187.92	603.17	29.97	1.90	7.98
T_{12} 150% RD as OM	184.10	670.08	30.33	1.47	7.02
CD (P=0.05)	NS	NS	NS	NS	NS

VC- Vermicompost; PM- Poultry manure; OM- Organic manure; NS- Non-significant

A positive effect of organic manures, vermicompost and poultry manure on seed yield has been documented earlier (Singh *et al,* 1997; Channabasanagowda *et al*, 2008; Menon *et al*, 2010). The differential action observed may be attributed to differences in mineralization rate and availability of the nutrients to the plants throughout their growth period. Yield attributes, pod size, pod weight, number of seeds per fruit and seed weight, also substantiate higher yields recorded in these treatments. Poultry manure at 25% substitution was found to be ideal for good seed yield but, at 50% substitution, the concentrated form and the uric acid present may have affected mother plant growth in the early stages, and have had a bearing on yielding ability of the mother crop.

Among seed quality parameters, germination percentage did not vary significantly with nutrient source (Table 2), while, 100-seed weight, vigour index and moisture content showed significant variation. Lowest vigour in seeds was recorded in the treatment T_8 at 50% N substitution with poultry manure, and with 150% recommended dose applied as chemical fertilizer (T_{11}).

The economics of seed production with the different sources of nutrients was worked out as the benefit:cost ratio (Table 3) and it was proven that irrespective of the treatment, BC ratio were more than one, the maximum being with 50 per cent POP nitrogen as vermicompost (2.09) on par with 25 % N substitution with poultry manure (2.00) and 100 % nutrients as chemicals (2.05) for the seed crop. Organic nutrition recorded significantly lower values for the BC ratios.

Detailed analysis revealed that chemical fertilizer, despite resulting in lower yields, gave a high B:C ratio due to lower cost of cultivation. In the treatments with organic manure, cost of cultivation was 16 to 39.80% higher, as, these were considered as purchased inputs. Nutrient content

Table 2. Seed yield and quality characters as influenced by various nutrient sources in cowpea

Treatment	Seed yield (kgha^{-1})	100 seed weight (g)	Germination (%)	Vigour index	Moisture (%)
T_1 100% RD as chemical fertilizer	351.77	16.48	89.81	2275.67	7.07
T_2 25% RDN & K - foliar	359.74	16.22	93.27	1851.33	6.30
T_3 50% RDN & K - foliar	355.67	14.19	86.60	2058.00	6.77
T_4 25% RDN as VC	284.53	15.61	93.27	2329.00	6.67
T_5 25% RDN as PM	413.38	17.05	96.61	2797.33	5.87
T_6 25% RDN as VC+PM	358.04	17.73	89.81	1994.00	6.63
T_7 50% RDN as VC	435.97	16.47	89.81	1910.67	7.57
T_8 50% RDN as PM	284.44	14.28	83.27	1669.00	6.03
T_9 50% RDN as VC+PM	333.13	15.33	96.61	2194.00	5.70
T_{10} 100 % RD as OM	421.75	17.14	93.27	2198.00	6.00
T_{11} 150% RD as chemical fertilizer	318.54	15.05	79.79	1733.33	6.10
T_{12} 150% RD as OM	409.33	16.16	96.61	2266.67	5.93
CD (P=0.05)	82.28	0.56	NS	904.55	0.73

VC- Vermicompost; PM- Poultry manure; OM- Organic manure; NS- Non-significant

Table 3. Cost of cultivation of seed crop in cowpea and Benefit:Cost ratio under various nutrient sources

Treatment	Cost of cultivation (Rs. ha^{-1})	B:C ratio
T_1 100% RD as chemical fertilizer	206300	2.07
T_2 25% RDN & K - foliar	218800	2.00
T_3 50% RDN & K - foliar	231300	1.87
T_4 25% RDN as VC	239310	1.45
T_5 25% RDN as PM	244960	2.05
T_6 25% RDN as VC+PM	246685	1.76
T_7 50% RDN as VC	253020	2.09
T_8 50% RDN as PM	246120	1.40
T_9 50% RDN as VC+PM	249570	1.62
T_{10} 100 % RD as OM	282140	1.81
T_{11} 150% RD as chemical fertilizer	219520	1.76
T_{12} 150% RD as OM	288360	1.72
CD (P=0.05)	0.054	

VC- Vermicompost; PM- Poultry manure; OM- Organic manure; NS- Non-significant

in organic materials varies greatly; vermicompost used in the study was prepared from crop residues including the banana pseudostem, leguminous materials and grasses, and contained 0.8 per cent nitrogen; while, poultry manure contained 1.2% N. This added to the quantum of material required and, hence, to the cost of cultivation. As a result, Benefit:Cost ratio, despite higher yield and gross returns, was narrowed down, especially when compared to use of chemicals. Organic nutrition, despite comparable yields, recorded lower profits on this account. This clearly proves that unless organic manures are produced *in situ* by the farmer, cost of cultivation would remain high, and B:C may could be even negative (incurring loss) despite reaping very good harvests. Reports of Sheela *et al* (2010) are in conformity with this observation.

Our study brings to light the importance of integration of nutrient sources for seed production in cow pea. Best yields can be realized by integrating chemical fertilizers with vermicompost, with requirement for nitrogen of the seed crop being met @ 50 per cent each from the two sources. The recommendation would be more economical if the vermicompost were produced *in situ* at the farm itself. Organic cultivation of cowpea seed crop can also be recommended with availability of various nutrients sources that can be integrated for commercial production.

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