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RESEARCH NOTE

Response of pigeonpea [*Cajanus cajan* (L.) Millsp] to nutrient management practices in intercropping system with sesame

R. V. VIVEKANANDA REDDY, B. G. KOPPALKAR, M. A. BASAVANEPPA, N. ANANDA AND K. NARAYANA RAO

Department of Agronomy
College of Agriculture
University of Agricultural Sciences
Raichur-584 104, Karnataka, India
E-mail: sanjanabgk@gmail.com

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A field experiment was conducted at Agricultural College Farm, Raichur on medium deep black soils during *Kharif* season of 2014 to study the influence on nutrient management practices of pigeonpea in the intercropping system with sesame. The sole crop pigeonpea produced significantly higher seed yield (1613 kg ha^{-1}), dry matter production at harvest (166.33 g plant-^{1}), dry matter accumulation in reproductive parts at harvest (36.91 g plant-^{1}), number of pods per plant (128.69), number of seeds per pod (3.65), seed weight per plant (42.47 g) and test weight (12.09 g) when compared to the intercropping treatments. Among the various intercropping treatments, the treatment which received 125 per cent RDF to pigeonpea and no fertilizer to sesame recorded significantly higher dry matter production, seed yield and yield components of pigeonpea when compared to other intercropped treatments and was found on par with treatments *viz.,* 100 per cent RDF to pigeonpea and 100% RDF to sesame, 100 per cent RDF to pigeonpea and 50% RDF to sesame and 100 per cent RDF to pigeonpea and no fertilizer to sesame.

Key words: Nutrient, Pigeonpea, Sesame

The main concept of intercropping is to get increased total productivity per unit area and time, besides judicious utilization of land resources and farming inputs including labour not to mention of insurance against failure of one or the other crops could be achieved. The researchers outlined the fertility relationship as a major category of agronomic studies and is necessary to maximize the yields in intercropping system, provided all other production factors are taken care of. Pigeonpea [*Cajanus cajan* (L.) Millsp.] and sesame (*Sesamum indicum*) differ morphologically and physiologically in growth habits. Pigeonpea, a deep rooted crop with slow initial growth rate between 45 and 60 days after sowing is well suited for intercropping. Intercropping is an intensive land use system with an objective to utilize the space between the rows of main or base crop and to get more produce per unit area. The space between the rows could be effectively utilized by growing a short duration crop, which may generate an additional income without adversely affecting the yield of pigeonpea (Jat and Ahlawat, 2010). Sesame being a short duration crop fits well as an intercrop with pigeonpea. In northern parts of Karnataka, intercropping of pigeonpea and sesame is being practiced mainly on black soils and the soils that are low in their fertility status. These crops are grown without any fertilizers or the fertilizers are being applied only for the main crop and that too in small quantity. This coupled with lack of proper management practices has led to lower production of both the crops. Hence, the present investigation was carried out to assess the performance of pigeonpea with respect to dry matter production, yield and yield parameters as influenced by pigeonpea and sesame (1:2) intercropping system under different combination of nutrients.

The present investigation was conducted during *kharif* season of 2014 at Agriculture College Farm, Raichur on medium black soils. The experiment comprised of 10 fertilizer treatments (eight interrcropped treatments and two sole crop treatments). The experiment was laid out in randomized block design with three replications. The varieties used were 'TS-3R' and 'DS-1' of pigeonpea and sesame, respectively. The sole crop of pigeonpea was sown with spacing of 90cm x 30cm and sole sesame was sown at spacing of 30cm x 15cm. In intercropping treatments, a common row spacing of 30 cm was maintained and within rows, pigeonpea and sesame was given a spacing of 30cm and 15cm, respectively. The recommended dose of fertilizer for pigeonpea (25:50 kg ha^{-1} of N and P_2O_5) and sesame (50:25:25 kg ha^{-1} of N, P_2O_5 and K_2O) were applied in the form of urea, diammonium phosphate and muriate of potash.

In intercropping treatments, nutrients to each crop were added at the time of sowing. Certified seeds of pigeonpea and, bold and healthy seeds of sesame were sown on 11th july 2014. Two seeds were dibbled in each spot for pigeonpea and in case of sesame, seeds were mixed with sand and sown in rows and the seedlings were thinned at 20 DAS to maintain required plant population.

Five tagged plants used for recording growth parameters were used for recording various yield components. For recording dry matter production, five plants at random were uprooted and separated into stem, leaves and reproductive parts, and were dried at 70 ^{o}C in hot air oven to a constant weight. The dried samples were weighed and dry weight of different plants parts was expressed in grams per plant. The sum of mean dry weight of all the plants parts was taken as the dry weight per plant and was expressed as gram per plant. The rainfall received during the crop period was adequate (875.3 mm) and well distributed. The crops were harvested at physiological maturity. Pods from each net plot were threshed, cleaned and the seed weight was recorded. From this seed yield per plant was computed. Fisher's method of analysis of variance was used for analysis and interpretation of data.

The sole crop of pigeonpea gave significantly higher seed yield (1613 kg ha^{-1}) as compared to intercropping treatments which ranged between 1175 to 1412 kg ha^{-1} (Table 2). The seed yield decreased in all the intercropped treatments to the extent of 12 to 27 per cent in comparison with sole crop of

pigeonpea. The lower yields of pigeonpea under intercropping system may be attributed to increased plant population pressure of main and intercrop together resulting in increased competition for nutrients, water, space and light compared to their respective sole crops. Similar results of decreased intercrop yields were reported in pigeonpea and sesame intercropping system (Sharma and Guled, 2011). The higher yields under sole crop of pigeonpea over intercropped pigeonpea was due to superior yield attributing characters *viz.,* number of pods per plant (128.69), number of seeds per pod (3.65), seed weight per plant (42.47 g plant^{-1}), test weight (12.09 g) and dry matter accumulation in reproductive parts (Table 1 and 2). Similar reduction in test weight in intercropped pigeonpea was observed by Tejpal Singh and Mahendrapal Singh (2003) under intercropping system with maize.

In intercropped pigeonpea under different combinations of nutrient application, the seed yield of pigeonpea obtained with treatments, T_4 (125 per cent RDF to pigeonpea and no fertilizer to sesame) (1412 kg ha^{-1}), T_6 (100 per cent RDF to pigeonpea and 100 per cent RDF to sesame) (1399 kg ha^{-1}), T_5 (100 per cent RDF to pigeonpea and 50 per cent RDF to sesame) (1371 kg ha^{-1}) and T_3 (100 per cent RDF to pigeonpea and no fertilizer to sesame) (1362 kg ha^{-1}) was significantly higher compared to T_{10} (125 per cent RDF of pigeonpea to all rows of both crops and 100 per cent RDK to sesame based on population) (1188 kg ha^{-1}), T_8 (125 per cent RDF of pigeonpea to all rows of both the crops and without RDK to sesame) (1184 kg ha^{-1}), T_9 (100 per cent RDF of pigeonpea to all rows of both crops and 100 per cent RDK to sesame based on population) (1179 kg ha^{-1}) and T_7 (100 per cent RDF of pigeonpea to all rows of both crops and without RDK to sesame) (1175 kg ha^{-1}). These results are in conformity with the findings of Padmavathi *et al.* (2003) in pigeonpea based intercropping system.

The increase in the seed yield of pigeonpea in T_4, T_6, T_5 and T_3 over T_7 was 20, 19, 17 and 16 per cent, respectively. The increased seed yield in these treatments was attributed to superior yield attributing characters viz., number of pods per plant, dry matter production, dry matter accumulation in reproductive parts, number of seeds per pod, seed weight per plant and test weight (Table 1 and 2) due to balanced nutrients application to pigeonpea, which reduced the competition from sesame.

Accumulation of dry matter in reproductive parts is the single most key factor contributing to the final seed yield. The data on dry matter accumulation in pigeonpea pods indicated that there was significant reduction in the dry matter accumulation in pods in intercropped pigeonpea when compared to that in sole cropped pigeonpea at 90,120 DAS and at harvest. Sole pigeonpea accumulated significantly higher dry matter in pods at 90, 120 DAS and harvest (7.94,

Table 1. Dry matter accumulation in reproductive parts (g plant^{-1}) and dry matter production (g plant^{-1})of pigeonpea at different stages of crop growth as influenced by nutrient management practices in pigeonpea and sesame (1:2) intercropping system

Treatment No	Treatment details	Dry matter accumulation in reproductive parts (g plant^{-1})			Dry matter production (g plant^{-1})				
		90DAS	120DAS	At harvest	30DAS	60DAS	90DAS	120DAS	At harvest
T_1	Sole pigeonpea with 100% RDF	7.94	24.25	36.91	9.56	33.35	85.61	118.21	166.33
T_2	Sole sesame with 100% RDF	—	—	—	—	—	—	—	—
T_3	100% RDF to pigeonpea and no fertilizer to sesame	5.62	19.59	29.73	7.27	26.13	66.36	90.96	132.97
T_4	125% RDF to pigeonpea and no fertilizer to sesame	5.85	19.77	29.92	7.48	26.61	67.29	92.87	133.60
T_5	100% RDF to pigeonpea and 50% RDF to sesame	5.66	19.65	29.78	7.25	26.25	66.59	92.03	133.12
T_6	100% RDF to pigeonpea and 100% RDF to sesame	5.73	19.71	29.86	7.35	26.40	66.83	92.21	133.38
T_7	100% RDF of pigeonpea to all rows of both the crops and without RDK to sesame	4.73	17.92	27.02	6.20	23.82	62.32	84.85	124.73
T_8	125% RDF of pigeonpea to all rows of both the crops and without RDK to sesame	4.86	18.04	27.16	6.36	24.02	63.15	85.35	125.14
T_9	100% RDF of pigeonpea to all rows of both crops and 100% RDK to sesame based on population	4.80	17.97	27.08	6.26	23.94	62.93	85.15	124.93
T_{10}	125% RDF of pigeonpea to all rows of both crops and 100% RDK to sesame based on population	4.92	18.10	27.23	6.44	24.10	63.33	85.56	125.36
	S.Em.±	0.20	0.47	0.81	0.26	0.57	1.02	1.33	2.17
	C.D.(P=0.05)	0.61	1.39	2.39	0.82	1.69	3.02	3.95	6.44

DAS = Days After Sowing

RDF: Recommended dose of fertilizerRDF of pigeonpea : 25:50 kg ha^{-1} of N and P_2O_5

RDK: Recommended dose of potassiumRDF of sesame : 50:25:25 kg ha^{-1} of N, P_2O_5 and K_2O

Table 2. Seed yield and yield components of pigeonpea as influenced by nutrient management practices in pigeonpea and sesame (1:2) intercropping system

Treatment	Treatment details	Number of pods per plant	Number of seeds per pod	Seed100 weight per plant (g)	seed weight (g)	Seed yield (kg ha^{-1})
T_1	Sole pigeonpea with 100% RDF	128.69	3.65	42.47	12.09	1613
T_2	Sole sesame with 100% RDF	—	—	—	—	—
T_3	100% RDF to pigeonpea and no fertilizer to sesame	120.03	3.46	34.29	10.67	1362
T_4	125% RDF to pigeonpea and no fertilizer to sesame	121.40	3.51	35.14	10.88	1412
T_5	100% RDF to pigeonpea and 50% RDF to sesame	120.37	3.47	34.72	10.70	1371
T_6	100% RDF to pigeonpea and 100% RDF to sesame	120.78	3.49	34.86	10.77	1399
T_7	100% RDF of pigeonpea to all rows of both the crops and without RDK to sesame	114.74	3.40	30.38	9.53	1175
T_8	125% RDF of pigeonpea to all rows of both the crops and without RDK to sesame	115.07	3.43	30.60	9.75	1184
T_9	100% RDF of pigeonpea to all rows of both crops and 100% RDK to sesame based on population	114.80	3.41	30.49	9.66	1179
T_{10}	125% RDF of pigeonpea to all rows of both crops and 100% RDK to sesame based on population	115.44	3.44	30.71	9.79	1188
	S.Em.±	1.47	0.14	1.15	0.26	58
	C.D.(P=0.05)	4.39	NS	3.44	0.77	173

RDF: Recommended Dose of Fertilizer — RDF of pigeonpea : 25:50 kg ha^{-1} of N and P_2O_5

RDK: Recommended Dose of Potassium — RDF of sesame : 50:25:25 kg ha^{-1} of N, P_2O_5 and K_2O

24.25 and 36.91 g plant^{-1}, respectively) when compared to intercropped pigeonpea (4.73 to 5.85, 17.92 to 19.77 and 27.02 to 29.92 g plant^{-1}, respectively) (Table 1). The reduction in dry matter accumulation in pods of intercropped pigeonpea was mainly attributed to reduced dry matter producing ability of intercropped pigeonpea. Lower percentage of dry matter distribution in pods of intercropped pigeonpea was attributed to the stress, which reduced the source strength and photosynthetic ability, thereby reducing sink strength by decreased translocation (Ramamoorthy *et al.,* 2004).

The dry matter produced per plant of pigeonpea (at 30, 60, 90,120 DAS and at harvest) was significantly reduced under intercropping system compared to sole cropped pigeonpea. The dry matter produced by pigeonpea under intercropping system was 6.20 to 7.48, 23.82 to 26.61, 62.32 to 67.29, 84.85 to 92.87 and 124.80 to 133.60 g plant^{-1} which was significantly lower than that of sole cropped pigeonpea (9.56 to 166.33 g plant^{-1}) at 30, 60, 90,120 DAS and at harvest, respectively (Table 1). The dry matter production per plant was increased upto harvest irrespective of sole or intercrop. There was significantly higher dry matter production in sole pigeonpea over all the intercropped treatments at all growth stages. When growth advanced at an increasing rate the competition for growth resources increased due to inter and intra species competition for moisture, nutrients and light, consequently resulting in low dry matter production under intercropped pigeonpea than in the sole cropped pigeonpea. The results supports the findings of Goud and Andhalkar (2012)

The dry matter production and accumulation in reproductive parts in T_4, T_6, T_5 and T_3 was 11, 11, 10 and 10 per cent higher, respectively over T_7 at the time of harvest (Table 1). This was due to the availability of balanced and optimum nutrients to crops which enhanced canopy index thereby photosynthetic efficiency coupled with greater translocation and accumulation in these economically important plant parts.

The intercropped treatment which recorded the lowest seed yield of pigeonpea (T_7) declined full dose fertilization in form of nutrients might have limited the growth resulting in reduced yield parameters causing reduction in seed yield.

From the results, it was concluded that the sole pigeonpea recorded significantly higher dry matter production, seed yield and yield attributes over intercropped treatments. Among the intercropped treatments, 125 per cent RDF to pigeonpea and no fertilizer to sesame recorded significantly higher dry matter production, seed yield and yield attributes and was on par with 100 per cent RDF to pigeonpea and 100% RDF to sesame, 100 per cent RDF to pigeonpea and 50% RDF to sesame, and 100 per cent RDF to pigeonpea and no fertilizer to sesame.

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