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NUTRIENT UPTAKE PATTERN OF PIGEONPEA AS INFULENCED BY PIGEONPEA + BLACKGRAM AND INTEGRATED NUTRIENT MANAGEMENT

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Abstract

Field experiment were conducted in Indira Gandhi Agriculture University, Raipur (C.G.) during *Kharif* 2015 to *Rabi* 2017. The experiment field was clayey with neutral pH. The experimrnt were laid out in split plot design with three replications consisted of pigeonpea and blackgram intercropping under cropping systems and integrated nutrient management *viz*., C_1-Pigeonpea sole (60 × 20cm), C_2-Black gram sole (30 × 10 cm), C_3-Normal planting of Pigeonpea (60 × 20 cm) + Blackgram (1 row), C_4-Paired planting of Pigeonpea (45/75 cm × 20 cm) + Blackgram (2 rows); F_0-Absolute control, F_1-100 % RDF, F_2-50 % RDF, F_3-FYM @ 5 t $ha^{-1,}$ F_4-100 % RDF + FYM @ 5 t ha^{-1}, F_5-100 % RDF+ *Rhizobium* + PSB + *Trichoderma*, F_6-50 % RDF+ FYM @ 5 t ha^{-1} and F_7-50% RDF+ FYM @ 5 t ha^{-1}+ *Rhizobium* + PSB + *Trichoderma*. The result revealed that maximum nutrient content and uptake was registered under sole crop and among the nutrient management practices,higher amount of nutrients and uptake of nutrients was recorded under F_7-50% RDF+ FYM @ 5 t ha^{-1}+ *Rhizobium* + PSB + *Trichoderma* and it was comparable with F_5-100 % RDF+ *Rhizobium* + PSB + *Trichoderma* during both the year.

Key words: INM, nutrient content, nutrient uptake, biofertilizers

Introduction

The greatest challenge of the 21st century in many developing countries are to produce more and more basic necessities namely food, fodder, fuel and fibre for ever increasing human and animal population from the limited available land. The availability of land for agriculture is shrinking every day as it is increasingly utilized for non-agricultural purposes. Under this situation, one of the important strategies to increase agricultural productivity and intensive land use is development of high intensity cropping systems including intercropping system. This has lead to the crisis of shortage of pulses in India, which has aggravated the problem of malnutrition. Thus, there is an urgent need to increase the production of pulses to meet the requirement by manipulating the production technologies appropriately. Pigeonpea, a deep rooted crop with slow initial growth rate between 60 and 70 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 produce more produce per unit area (Nagar *et al.,* 2015). Blackgram being an efficient cover crop fits well in this system. The greatest limitation of increasing productivity of these crops is inadequate supply of nutrients since the soils of arid region are poor in native fertility and continuous application of inorganic fertilizers even in balanced from may not sustain soil fertility and productivity (Kumawat *et al.,* 2013). Integrated nutrient management includes the intelligent use of organic, inorganic, and on-line biological resources so as to sustain optimum yields, improve or maintain the soil physical and chemical properties, and provide crop nutrition packages which are technically sound, economically attractive, practically feasible and environmentally safe.

Materials and Methods

The experiment was conducted during four consecutive *Kharif- Rabi* season from 2015 and 2017 at Indira Gandhi Agriculture University, Raipur, CG (India). The experiment was laid out in split plot design with three replications consisted of pigeonpea and blackgram intercropping under cropping systems and integrated nutrient management *viz*., C_1-Pigeonpea sole (60 × 20cm),

C_2-Black gram sole (30 × 10 cm), C_3-Normal planting of Pigeonpea (60 × 20 cm) + Blackgram (1 row), C_4-Paired planting of Pigeonpea (45/75 cm × 20 cm) + Blackgram (2 rows); F_0-Absolute control, F_1-100 % RDF, F_2-50 % RDF, F_3-FYM @ 5 t ha^{-1}, F_4-100 % RDF + FYM @ 5 t ha^{-1}, F_5-100 % RDF+ *Rhizobium* + PSB + *Trichoderma*, F_6-50 % RDF+ FYM @ 5 t ha^{-1} and F_7-50% RDF+ FYM @ 5 t ha^{-1}+ *Rhizobium* + PSB + *Trichoderma*. The soil of experiment field was *'Vertisols'* which is locally known as *'Kanhar"*. The soil was neutral in reaction and medium in fertility having low N, medium P and K. The climate having sub humid climatic condition with an average of 1170 mm annual rainfall. The seed rate was 20 kg ha^{-1} for pigeonpea and 15 kg ha^{-1} for blackgram. The seed rate was regulated according to the proportion of area under each crop component in intercropping situations.

Results and Discussion

Pigeonpea

Effect on nutrient content

Total N, P and K content significantly influenced by cropping system. Significantly highest N, P and K content was recorded under sole blackgram (C_1) (table 1). However, it was at par with pigeonpea + blackgram 1:1 (C_3) for K content during both the year and their mean. Application of F_7-50% RDF+ FYM @ 5 t ha^{-1}+ *Rhizobium* + PSB + *Trichoderma* found significantly superior over other. However it was at par with F_4-100 % RDF + FYM @ 5 t ha^{-1}, F_5-100 % RDF+ *Rhizobium* + PSB + *Trichoderma* and F_6-50 % RDF+ FYM @ 5 t ha^{-1} for N and P content during both the year and their mean. K content was also at par with F_6-50 % RDF+ FYM @ 5 t ha^{-1} during 2017 and mean of both the year. This might be due to fertilization increases the cation exchange capacity of plant roots and thus makes them more efficient in absorbing nutrients. These findings are accordance with the result of Patil and Padmani (2007).

Table 1: N, P and K content (%) of pigeonpea as influenced by intercropping and integrated nutrient management.

Treatment	Nutrient content %								
	N			P			K		
	2016	2017	Mean	2016	2017	Mean	2016	2017	Mean
Cropping systems									
C_1	4.07	4.22	4.14	0.51	0.57	0.54	2.03	2.16	2.1
C_2									
C_3	3.83	3.95	3.89	0.48	0.53	0.51	1.92	1.98	1.95
C_4	3.48	3.61	3.54	0.39	0.41	0.4	1.72	1.73	1.73
SEm±	**0.06**	**0.06**	**0.06**	**0.00**	**0.00**	**0.00**	**0.06**	**0.06**	**0.06**
CD at 5%	**0.24**	**0.25**	**0.24**	**0.01**	**0.01**	**0.01**	**0.24**	**0.25**	**0.24**
Integrated nutrient management									
F_0	2.93	3.04	2.98	0.39	0.43	0.42	1.36	1.43	1.39
F_1	3.83	3.97	3.89	0.44	0.49	0.47	1.84	1.94	1.88
F_2	3.29	3.4	3.34	0.43	0.46	0.44	1.51	1.56	1.54
F_3	3.55	3.68	3.61	0.44	0.48	0.46	1.74	1.81	1.77
F_4	4.13	4.28	4.2	0.51	0.53	0.53	2.12	2.19	2.16
F_5	4.26	4.40	4.33	0.5	0.56	0.53	2.23	2.32	2.28
F_6	4.00	4.13	4.07	0.46	0.5	0.48	2.03	2.1	2.06
F_7	4.39	4.5	4.45	0.54	0.57	0.55	2.29	2.33	2.32
SEm±	**0.15**	**0.15**	**0.15**	**0.01**	**0.01**	**0.01**	**0.15**	**0.15**	**0.15**
CD at 5%	**0.43**	**0.43**	**0.42**	**0.02**	**0.03**	**0.02**	**0.43**	**0.43**	**0.42**

Table 2: Nutrient uptake (kg ha^{-1}) by pigeonpea seed as influenced by intercropping and integrated nutrient management.

Treatment	Nutrient uptake (kg ha^{-1})								
	N			P			K		
	2016	2017	Mean	2016	2017	Mean	2016	2017	Mean
Cropping systems									
C_1	57.33	60.43	58.88	11.26	12.03	11.65	111.20	117.19	114.20
C_2	-	-	-	-	-	-	-	-	-
C_3	51.03	57.34	54.19	9.80	10.58	10.19	101.65	106.71	104.18
C_4	44.64	48.86	46.75	9.78	10.15	9.97	92.08	93.06	92.57
SEm±	**1.67**	**1.69**	**1.58**	**0.26**	**0.30**	**0.27**	**1.86**	**2.33**	**1.57**
CD at 5%	**6.56**	**6.64**	**6.21**	**1.01**	**1.16**	**1.06**	**6.07**	**7.58**	**5.78**
Integrated nutrient management									
F_0	29.74	29.97	29.86	8.75	9.15	8.95	61.91	63.70	62.81
F_1	50.89	55.88	53.39	9.67	10.78	10.22	97.73	101.45	99.59
F_2	40.05	42.19	41.12	9.32	9.74	9.53	74.13	76.68	75.41
F_3	44.91	47.36	46.14	9.36	10.12	9.74	89.55	92.37	90.96
F_4	56.86	63.72	60.29	10.85	11.35	11.10	120.01	124.63	122.32
F_5	64.28	70.74	67.51	11.72	12.26	11.99	127.52	132.44	129.98
F_6	54.42	60.24	57.33	10.23	11.03	10.63	111.28	115.63	113.46
F_7	66.85	74.25	70.55	12.35	12.92	12.64	131.00	138.34	134.67
SEm±	**2.14**	**2.87**	**1.99**	**0.44**	**0.54**	**0.47**	**2.03**	**2.53**	**2.00**
CD at 5%	**6.10**	**8.18**	**5.69**	**1.25**	**1.53**	**1.35**	**6.66**	**7.86**	**5.96**

Table 3: Nutrient content (%) of blackgram as influenced by intercropping and integrated nutrient management.

Treatment	Nutrient content %								
	N			P			K		
	2016	2017	Mean	2016	2017	Mean	2016	2017	Mean
Cropping systems									
C_1	-	-	-	-	-	-	-	-	-
C_2	4.85	5.27	5.06	0.56	0.58	0.57	2.57	2.59	2.58
C_3	4.59	4.69	4.64	0.52	0.55	0.54	2.28	2.38	2.33
C_4	4.21	4.21	4.22	0.42	0.44	0.43	1.63	1.65	1.64
SEm±	**0.18**	**0.13**	**0.15**	**0.01**	**0.01**	**0.01**	**0.06**	**0.06**	**0.06**
CD at 5%	**0.7**	**0.5**	**0.57**	**0.04**	**0.04**	**0.03**	**0.24**	**0.25**	**0.24**
Integrated nutrient management									
F_0	3.85	4.07	3.96	0.39	0.43	0.41	1.58	1.68	1.64
F_1	4.46	4.57	4.52	0.51	0.51	0.51	2.30	2.18	2.23
F_2	4.01	4.23	4.12	0.45	0.49	0.46	1.67	1.70	1.68
F_3	4.2	4.43	4.31	0.48	0.49	0.48	2.02	2.11	2.07
F_4	4.85	5.00	4.92	0.54	0.55	0.54	2.40	2.43	2.42
F_5	5.03	5.10	5.07	0.55	0.56	0.55	2.29	2.33	2.31
F_6	4.78	4.91	4.84	0.52	0.53	0.53	2.37	2.45	2.41
F_7	5.23	5.49	5.36	0.58	0.62	0.61	2.63	2.76	2.69
SEm±	**0.21**	**0.19**	**0.17**	**0.02**	**0.02**	**0.02**	**0.15**	**0.15**	**0.15**
CD at 5%	**0.6**	**0.54**	**0.5**	**0.06**	**0.07**	**0.05**	**0.43**	**0.43**	**0.42**

Table 4: Nutrient uptake (kg ha^{-1}) by blackgram seed as influenced by intercropping and integrated nutrient management.

Treatment	Nutrient uptake (kg ha^{-1})								
	N			P			K		
	2016	2017	Mean	2016	2017	Mean	2016	2017	Mean
Cropping systems									
C_1	-	-	-	-	-	-	-	-	-
C_2	59.73	62.95	61.34	7.29	6.77	7.03	33.70	35.47	34.58
C_3	33.20	37.61	35.40	4.98	4.57	4.78	29.47	30.86	30.17
C_4	37.07	38.59	37.83	4.43	4.35	4.39	27.85	29.40	28.63
SEm±	**1.43**	**1.93**	**1.64**	**0.21**	**0.17**	**0.18**	**0.69**	**0.73**	0.71
CD at 5%	**5.63**	**7.56**	**6.43**	**0.84**	**0.67**	**0.73**	**2.70**	**2.88**	2.78
Integrated nutrient management									
F_0	32.57	33.29	32.93	4.02	3.40	3.71	19.33	20.16	19.75
F_1	39.29	45.99	42.64	5.31	4.67	4.99	30.23	31.94	31.08
F_2	39.74	41.74	40.74	4.74	4.25	4.49	21.59	22.47	22.03
F_3	36.89	39.65	38.27	5.14	4.42	4.78	27.11	28.60	27.86
F_4	45.78	48.74	47.26	6.22	5.54	5.88	34.90	36.72	35.81
F_5	52.53	55.73	54.13	6.32	6.58	6.45	36.35	38.33	37.34
F_6	43.57	45.92	44.74	5.66	5.48	5.57	32.13	33.80	32.96
F_7	56.30	60.02	58.16	7.12	7.50	7.31	41.09	43.26	42.17
SEm±	**2.42**	**2.17**	**2.20**	**0.35**	**0.33**	**0.32**	**1.95**	**2.05**	**2.00**
CD at 5%	**6.90**	**6.20**	**6.29**	**1.01**	**0.95**	**0.91**	**5.57**	**5.86**	**5.71**

Effect on nutrient uptake

Total uptake of plant nutrients was significantly higher with sole cropping system as compare to normal and paired planting system during both the year and their mean. However, total N uptake by plant at par with pigeonpea + blackgram 1:1 (C_3) during both the year and their mean. Concerning to integrated nutrient management practices, significantly highest value of these nutrients were recorded under F_7-50% RDF+ FYM @ 5 t ha^{-1}+ *Rhizobium* + PSB + *Trichoderma.* It was found statistically at with F_5-100 % RDF+ *Rhizobium* + PSB + *Trichoderma* during both the year and their mean. This might be attributed to the reason that, due to bacterial activities, more of the nutrients were being made available to the crop by nitrogen fixation as well as release of native phosphates and potassium. These results are accordance with the Patra *et al.* (2015) and Kumawat *et al.* (2013).

Blackgram

Effect on nutrient content

Maximum N, P and K content was recorded under sole blackgram which was significantly superior over others. However it was at par with pigeonpea + blackgram 1:1 (C_3). Among the nutrient management practices, significantly Higher amount of nutrients was recorded under F_7-50% RDF+ FYM @ 5 t ha^{-1}+ *Rhizobium* + PSB + *Trichoderma.*and it was at par with F_4-100% RDF+ FYM @ 5 t ha^{-1} and F_5-100 % RDF+ *Rhizobium* + PSB + *Trichoderma* during both the year of experimentation and their mean. This might be due to.

Effect on nutrient upatake

Data revealed that maximum nutrient uptake by blackgram was recorded under sole crop which was significantly superior over others. Application of F_7-50% RDF+ FYM @ 5 t ha^{-1}+ *Rhizobium* + PSB + *Trichoderma* gave the maximum total nutrient uptake being at par with F_5-100% RDF+ *Rhizobium* + PSB + *Trichoderma*. It may be due to integrated nutrient supply of increase proliferous root system, bacterial activity and availability of nutrients coupled with favourable solubility action of organic acids produced during the mineralization of FYM along with improved soil physical environment. Similar results were recorded by Patil and Padmani (2007) and Nagar *et al.* (2015).

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