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EFFECT OF SORGHUM AND NITROGEN LEVELS ON LEGUME INTERCROPS

M.L.GUPTA
Krishi Vigyan Kendra
Rajasthan Agricultural University
Dausa 303 303

ABSTRACT

A 2 year rainfed experiment consisting of intercropping of 3 legumes, black gram *Vigna mungo* (Linn) Hepper) pigeonpea *(Cajanus cajan* (Linn. Millsp.) and soybean *Glycine max* (linn) Merr.) in between wide (60 cm) and paired (30/60 cm) rows of sorghum (*Sorghum bicolor* (Linn) Moench) with 4 N levels *i.e.* 0.40, 80 and 120 kg/ha applied to sorghum crop showed that grain and straw yields of legume were higher in wide row inter cropping system as compared to paired row intercropping. Application of N to sorghum crop reduced pods/plant, grain weight/plant, grain and straw yield of black gram and pigeonpea while soybean remained unaffected. Maturity period of black gram and pigeanpea was also delayed by N application to sorghum crop.

KEY WORDS : Legume Intercrops, Nitrogen, Sorghum, Effect

The concept of inter-cropping of two or more crops has assumed considerable significance. When two crops of dissimilar nutrient requirements are grown together, it becomes operationally difficult to meet the nutritional requirement of the crop simultaneously. A cereal-legume intercropping system is a case in point where heavy nitrogen fertilization of control is not conducive to growth of legume component (Donald, 1963; Haynes, 1980) In the present investigation, observations were made on the effect of sorghum and N levels on yield behaviour of intercrop legumes.

MATERIALS AND METHODS

A rainfed experiment was conducted during *Kharif*, 1980 and 1981 at Aklera (Jhalawar) having typical sub-tropical climate and average rainfall of 1000 mm, most of which is received, during July to September. However, the rain fall received during two crop seasons were 709.2 and 679.0 mm. The clayey soil of the field had a pH of 7 .4 with 0.04% total N, 11.3 kg/ha of available P and 290 kg/ha of available K.

The treatments consisted of inter-cropping of 3 legumes *viz.*, 'Krishnan' black gram 'T-21' pigeonpea and 'punjab - 1' soybean in between wide (60cm) and paired (30-60 cm) rows of 'CSH-5' sorghum. These treatments were superimposed with 4 levels of N i.e., 0.40, 80 and 120 kg/ha. The experiment was planned in split plot design technique for field experiments, taking methods of planting and intercropping as main plot and nitrogen levels as sub-plot treatments with 4 replications. Phosphorus was basally applied in the whole plot at the rate of 17.5 kg p/ha through single super phosphate. However, N was applied in two splits to sorghum crop only. Uniform plant population of sorghum (150,000/ha) was maintained while intercrops population varied with number of rows of inter-crop in the treatment.

RESULTS AND DISCUSSION

Yield attributes

Planting of legumes in wide or paired rows of sorghum had no significant effect on days to 50 per cent flowering, pods/plant and grain weight/plant in all the three intercrops (Table 1). However, application of nitrogen to sorghum crop reduced the number of pods/plant of intercropped black gram and pigeonpea.

Soybean remained unaffected in these parameters. The mean pods/plant of black gram reduced from 10.6 under no nitrogen to 1.7 under 120 kg level of N, while in pigeonpea, the corresponding number of pods/plant recorded were 62.3 and 28.6. Higher levels of N application to sorghum also delayed maturity period of black gram and pigeonpea intercrops. The flowering in black gram and pigeonpea was delayed by 3.5 and 5.9 days, respectively by 120 kg N application as compared to control.

Table 1. Effect of sorghum and N levels on yield attributing characters of legume intercrops

Treatment	Days to 50% flowering			Pods/plant			Grain wt. (g/plant)		
	1980	1981	Mean	1980	1981	Mean	1980	1981	Mean
				Black gram					
Wide rows	48.9	48.0	48.4	4.6	4.8	4.7	1.21	1.18	1.19
Paired rows	49.9	48.4	49.1	5.3	5.1	5.2	1.38	1.26	1.32
C.D. at 5%	NS	NS	–	NS	NS	–	NS	NS	–
N_0	47.9	46.5	47.2	11.0	10.2	10.6	2.96	2.54	2.75
N_{40}	49.2	47.2	48.2	4.9	5.0	5.0	1.23	1.29	1.26
N_{80}	49.6	48.7	49.1	2.7	2.5	2.6	0.59	0.59	0.59
N_{120}	51.0	50.5	50.7	1.4	2.0	1.7	0.40	0.52	0.46
C.D. at 5%	1.72	1.56	–	0.89	0.80	–	0.30	0.17	–
				Pigeonpea					
Wide rows	103.4	105.5	104.4	32.4	53.6	43.0	3.97	6.25	5.11
Paired rows	106.9	107.1	107.0	29.6	49.7	39.7	3.70	5.73	4.71
C.D. at 5%	NS	NS	–	NS	NS	–	NS	NS	–
N_0	102.2	104.0	103.1	51.7	72.9	62.3	6.14	8.21	7.17
N_{40}	102.2	103.4	102.8	29.8	46.6	38.2	3.59	3.63	4.60
N_{80}	107.8	107.6	107.7	24.5	47.9	36.2	3.04	5.43	4.23
N_{120}	108.2	110.2	109.2	18.0	39.3	28.6	2.54	4.69	3.63
C.D. at 5%	1.45	2.61	–	6.46	6.90	–	0.65	0.40	–
				Soybean					
Wide rows	46.0	45.9	46.0	12.0	8.1	10.3	1.60	1.27	1.46
Paired rows	46.6	44.9	45.7	10.5	6.8	8.4	1.26	1.18	1.22
C.D. at 5%	NS	NS	–	NS	NS	–	NS	NS	–
N_0	46.7	45.9	46.3	11.3	7.9	9.6	1.29	1.18	1.23
N_{40}	46.0	44.5	45.2	11.6	7.0	9.3	1.37	1.20	1.28
N_{80}	46.6	45.4	45.0	10.8	7.6	9.2	1.43	1.24	1.33
N_{120}	46.0	45.7	45.8	11.2	7.2	9.2	1.53	1.29	1.40
C.D. at 5%	NS	NS	–	NS	NS	–	NS	NS	–

Grain and straw yield

Grain yield of legume intercrops obtained from wide row intercropping were higher than that of paired row intercropping (Table 2) It has already been pointed out that pods/plants in legume intercrops, the yield determinant was on par in both the systems of planting which resulted in similar grain weight/ plant. This attests that the higher yield in wide row intercropping was obtained due to higher plant population of legume intercrops, as more number of rows (50%) could be accommodated in wide row planting system. Higher level of light interception, after the harvest of sorghum by higher plant population of pigeonpea in wide row intercropping (Natarajan and Willey, 1979) might have also reflected in grain yield of pigeonpea. Similar trend was observed in case of straw yield.

The grain and straw yield of black gram and pigeonpea was reduced significantly with N application to sorghum crop. Mean grain yield under 120 kg N level was reduced to 20.12 per cent

Table 2. Effect of sorghum and N levels on yield of legume intercrops

Treatment	Grain yield (q/ha)			Straw yield (q/ha)		
	1980	1981	Mean	1980	1981	Mean
			Black gram			
Wide rows	1.63	1.82	1.73	6.50	7.02	6.76
Paired rows	1.25	1.31	1.28	4.52	4.80	4.66
C.D. at 5%	0.108	0.273	–	1.399	1.109	–
N_0	3.08	3.28	3.18	8.02	7.33	7.68
N_{40}	1.23	1.34	1.28	5.18	6.13	5.66
N_{80}	0.93	0.92	0.92	4.58	5.22	4.90
N_{120}	0.54	0,74	0.64	4.26	4.96	4.61
C.D. at 5%	0.239	0.036	–	1.171	0.928	–
			Pigeonpea			
Wide rows	2.83	5.19	4.01	21.90	32.03	26.96
Paired rows	2.36	3.52	2.94	15.46	22.61	19.04
C.D. at 5%	NS	NS	–	6.626	6.885	–
N_0	3.84	5.86	4.85	22.27	31.65	26.96
N_{40}	2.97	4.31	3.64	19.93	27.65	23.94
N_{80}	2.07	4.03	3.05	16.82	25.69	21.26
N_{120}	1.49	3.21	2.35	15.72	24.01	19.87
C.D. at 5%	0.531	0.927	–	2.017	3.485	–
			Soybean			
Wide rows	2.04	2.34	2.19	4.79	5.38	5.09
Paired rows	1.28	1.33	1.31	3.24	3.80	3.52
C.D. at 5%	NS	0.511	–	NS	NS	–
N_0	1.63	1.73	1.68	3.76	4.33	4.04
N_{40}	1.65	1.81	1.73	3.389	4.20	4.04
N_{80}	1.62	1.95	1.79	3.86	5.13	4.49
N_{120}	1.75	1.84	1.80	4.53	4.69	4.61
C.D. at 5%	NS	NS	–	NS	NS	–

in black gram and 48.45 per cent in pigeonpea as compared to the yield of respective crops at no nitrogen level. The reduction in grain and straw yields of intercropped black gram and pigeonpea might be due to smothering effects of sorghum which also delayed flowering of these two crops. The increased availability of nitrogen improved sorghum growth which might have resulted in the interference in penetration of solar radiation. The reduced fixing ability due to shading associated with poor ability to compete for mineral N are the suggested cause of ield reduction of legumes when N is supplied to cereal component in sorghum-legume intercropping.

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