

Effect of graded levels of phosphorus and foliar fertilization on short duration redgram in rainfed Vertisol

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Abstract : Field experiments were conducted at Regional Research Station, Aruppukottai during the rabi seasons of 1998-99, 1999-2000 and 2000-2001 to study the effect of graded levels of phosphorus and foliar nutrition on short duration redgram in rainfed Vertisol. The pooled data revealed that application of 37.5 kg P₂O₅ ha⁻¹ had recorded higher grain yield of 958 kg ha⁻¹ with a net income of Rs.9338 ha⁻¹ and B-C ratio of 2.32 than 12.5 kg P₂O₅ ha⁻¹ but on par with application of 25 kg P₂O₅ ha⁻¹. Foliar application of di-ammonium phosphate two per cent had improved the grain yield and income with high B-C ratio.

Key words : Short duration redgram, Phosphorus, Foliar nutrition

Introduction

Redgram (*Cajanus cajan* L.) is an important grain legume, mostly grown as intercrop with cereals and oil seeds and also as pure crop under rainfed condition. Pulses can meet their nitrogen requirement by symbiotic fixation of atmospheric nitrogen. However, a starter dose of nitrogen and adequate phosphorus are considered as essential for obtaining optimum yield. Phosphorus next to nitrogen, is the most limiting nutrient in Vertisol. The lack of P response in Vertisol is attributed to high clay content and immediate fixation. Limited information is available on the response

of short duration redgram to higher level of phosphorus and foliar application of plant nutrients and growth regulators in rainfed Vertisol. Therefore the present investigation was undertaken.

Materials and Methods

Field experiments were conducted at Regional Research Station, Aruppukottai during the rabi seasons of 1998-99, 1999-2000 and 2000-2001, to study the effect of graded levels of phosphorus and foliar fertilization on short duration redgram in rainfed Vertisol. Treatments consisted of three levels of phosphorus viz. 12.5, 25.0 and 37.5

Table 1. Growth and yield attributes of redgram during 1998-1999.

Treatments	Plant height at harvest (cm)	Number of pods plant ⁻¹	No. of seeds pod ⁻¹	100 grain weight (g)
<i>Main plot (Phosphorus levels)</i>				
P ₁ - 12.5 kg ha ⁻¹	109	56.3	4.2	10.6
P ₂ - 25.0 kg ha ⁻¹	116	64.5	4.8	10.7
P ₃ - 37.5 kg ha ⁻¹	117	68.5	4.9	10.8
CD 5%	2.1	2.6	0.1	0.1
<i>Sub plot (Foliar nutrition)</i>				
F ₁ - DAP 2%	113	71.0	5.0	11.3
F ₂ - Urea 1%	116	62.5	4.5	10.8
F ₃ - NAA 40 ppm	112	67.0	4.7	11.1
F ₄ - Mepiquat chloride 125 ppm	113	60.0	4.5	10.4
F ₅ - NSKE 5%	113	55.0	4.5	10.0
CD 5%	NS	3.2	0.2	0.3

NSKE : Neem Seed Kernal Extract

Table 2. Effect of phosphorus and foliar nutrition on growth and yield attributes of redgram during 1999-2000

Treatments	Plant height at harvest (cm)	Number of pods plant ⁻¹	No. of seeds pod ⁻¹	100 grain weight (g)
<i>Main plot (Phosphorus levels)</i>				
P ₁ - 12.5 kg ha ⁻¹	102	33.6	5.0	11.0
P ₂ - 25.0 kg ha ⁻¹	107	39.6	5.2	12.6
P ₃ - 37.5 kg ha ⁻¹	108	41.7	5.3	12.8
CD 5%	1.2	1.0	0.07	0.61
<i>Sub-plot (Foliar nutrients)</i>				
F ₁ - DAP 2%	109	45.2	5.3	12.7
F ₂ - Urea 1%	104	36.6	5.1	12.1
F ₃ - NAA 40 ppm	107	37.8	5.2	12.3
F ₄ - Mepiquat chloride 125 ppm	104	35.2	5.0	11.7
F ₅ - NSKE 5%	105	36.6	5.2	12.0
CD 5%	NS	1.4	0.17	0.5

Table 3. Effect of phosphorus and foliar nutrition on growth and yield attributes of redgram during 2000-2001

Treatments	Plant height at harvest (cm)	Number of pods plant ⁻¹	No. of seeds pod ⁻¹	100 grain weight (g)
<i>Main plot (Phosphorus levels)</i>				
P ₁ - 12.5 kg ha ⁻¹	83.7	23.4	4.12	9.60
P ₂ - 25.0 kg ha ⁻¹	92.6	29.2	4.22	10.49
P ₃ - 37.5 kg ha ⁻¹	96.4	31.7	4.25	10.63
CD 5%	1.2	1.5	NS	0.31
<i>Sub-plot (Foliar nutrients)</i>				
F ₁ - DAP 2%	93.7	31.0	4.42	10.53
F ₂ - Urea 1%	93.0	28.0	4.19	10.26
F ₃ - NAA 40 ppm	89.9	29.2	4.19	10.44
F ₄ - Mepiquat chloride 125 ppm	89.7	26.3	4.09	10.32
F ₅ - NSKE 5%	20.0	29.4	4.29	10.06
CD 5%	NS	5.6	NS	0.44

kg P₂O₅ ha⁻¹ and five foliar nutrition viz. DAP 2%, Urea 1%, NAA 40 ppm, Mepiquat chloride 125 ppm and Neem Seed Kernal Extract (NSKE) 5%. During third year of the experiment, an additional foliar treatment involving cow's urine 10 per cent was included in the treatment schedule.

During the cropping season, a total rainfall of 460 mm (23 rainy days), 333 mm (19 rainy days) and 432 mm (25 rainy days) were received during 1998-99, 1999-2000 and 2000-2001 respectively. The experiment was laid out in split plot design replicated thrice. A short duration

Table 4. Pooled mean for yield and economics

Treatment Details	Grain yield (kg ha ⁻¹)					Net income (Rs ha ⁻¹)					B-C Ratio				
	1998-1999	1999-2000	2000-2001	Mean	1998-1999	1999-2000	2000-2001	Mean	1998-1999	1999-2000	2000-2001	1998-1999	1999-2000	2000-2001	Mean
<i>Phosphorus levels (kg ha⁻¹)</i>															
P ₁ - 12.5	982	1146	464	866	9746	11448	1474	7584	2.64	2.6	1.25	2.6	2.6	1.25	2.19
P ₂ - 25.0	1061	1223	502	931	10859	12580	1933	8493	2.78	2.8	1.32	2.8	2.8	1.32	2.30
P ₃ - 37.5	1101	1237	526	958	11362	12699	2180	8790	2.81	2.8	1.35	2.8	2.8	1.35	2.32
CD 5 %	22	35	11	35	327	573	179	567	NS	0.1	0.03	0.1	0.1	0.03	0.05
<i>Foliar spray</i>															
F ₁ - DAP 2%	1174	1244	527	982	12736	12928	2372	9338	3.10	2.8	1.39	2.8	2.8	1.39	2.44
F ₂ - Urea 1%	1002	1208	489	899	10044	12374	1822	8077	2.67	2.7	1.30	2.7	2.7	1.30	2.24
F ₃ - NAA 40 ppm	1114	1205	509	943	11692	12274	2021	8662	2.91	2.7	1.33	2.7	2.7	1.33	2.33
F ₄ - Mep. chloride 125 ppm	1000	1170	497	889	9645	11674	1598	7639	2.52	2.6	1.25	2.6	2.6	1.25	2.14
F ₅ - NSKE 5%	951	1184	507	880	9162	11962	2062	7729	2.51	2.7	1.34	2.7	2.7	1.34	2.18
CD 5 %	21	32	27	28	312	503	424	912	0.05	0.1	0.06	0.05	0.1	0.06	0.15

(100 days) redgram cv. APK 1 was sown as test crop. The experimental site was clay loam having pH 8.0 with low organic carbon (0.35%) and available N (126 kg ha⁻¹) medium P (11.8 kg ha⁻¹) and high available K (285 kg ha⁻¹). The recommended level of nitrogen at 12.5 kg ha⁻¹ along with phosphorus as per treatment was applied just before sowing. Foliar application of plant nutrients and growth regulators were given on 55 and 70 days after sowing by preparing the spray fluid in 500 litre of water ha⁻¹.

Results and Discussion

Effect of phosphorus

Increased level of phosphorus significantly influenced the growth characters, yield components and grain yield. Application of 37.5 kg P₂O₅ kg⁻¹ had significantly improved the plant height, number of pods per plant, hundred grain weight when compared to 12.5 kg P₂O₅ ha⁻¹ but was on par with 25 kg P₂O₅ ha⁻¹ (Table 1-3). Highest grain yield of 1101, 1237 and 526 kg ha⁻¹ which was 12.1, 7.9 and 13.4 per cent higher than application of 12.5 kg P₂O₅ ha⁻¹ and 3.8, 1.2 and 4.8 per cent higher than application of 25 kg P₂O₅ ha⁻¹ during 1998-99, 1999-2000 and 2000-2001 respectively. However, no significant difference in the yield between application of 25 and 37.5 kg P₂O₅ ha⁻¹ was observed. The pooled data revealed that application of 37.5 kg ha⁻¹ had registered higher mean grain yield of 958 kg ha⁻¹ with a net income of Rs.8790 ha⁻¹ with a B-C ratio of 2.32 than application of 12.5 kg P₂O₅ ha⁻¹ but was on par with the application of 25 kg P₂O₅ ha⁻¹ which recorded a grain yield of 931 kg ha⁻¹, with a net income of Rs.8493 ha⁻¹ and B-C ratio of 2.30 (Table 4). Increased level of phosphorus might have improved the growth, yield attributes and grain yield in low to medium P available soil. Similar response to increased level of phosphorus was reported by Nimje (1995) and Sarawgi *et al.* (1999).

Effect of foliar fertilization

There was no significant difference in plant height among the foliar application of plant nutrients and growth regulators. Among the foliar nutrition treatments, significant

improvement in number of pods per plant, hundred seed weight and grain yield were observed due to foliar application of DAP which was closely followed by NAA application (Table 1-3). Foliar application of two per cent DAP had recorded significantly higher grain yield of 1174, 1244 and 527 kg ha⁻¹ during 1998-99, 1999-2000 and 2000-2001 respectively. Under moisture stress condition during 2000-2001, there was no significant difference in grain yield between foliar application of DAP and NAA. Foliar application of DAP might have helped for better absorption and translocation of nutrients at flowering and pod development stage which intern increased the pod retention, seed weight and finally seed yield. Similar yield increase due to foliar application of DAP at flowering and pod development was reported in blackgram by Mathan *et al.* (1996) and in redgram by Solaiappan and Ramiah (1990).

The mean data on economics revealed that foliar application of two per cent DAP twice had given higher net income of Rs.9338 ha⁻¹ and B-C ratio of 2.44. In conclusion, basal application of 37.5 kg P₂O₅ ha⁻¹ along with recommended level N at 12.5kg ha⁻¹ and foliar application of two per

cent di-ammonium phosphate twice on 50 and 70 DAS gave highest grain yield and income in redgram under rainfed situation.

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