Indian Journal of Agronomy **44** (3) : 499—503 (September 1999)

Phosphorus management in opium-poppy (*Papaver somniferum*)—based cropping system

N. S. SOLANKI, O. L. SHARMA AND M. P. SAHU

Rajasthan College of Agriculture, Rajasthan Agriculture University, Udaipur-313001

Received: January 1998

ABSTRACT

A field experiment was conducted during *kharif* and *rabi* seasons of 1990-93 to study phosphorus management (control, 40 kg P_2O_5/ha in *kharif,* 40 kg P_2O_5/ha in *rabi* and 40 kg P_2O_5/ha in *rabi* and *kharif* both on opium-poppy in poppy (*Papaver sommiferum* L.)–based cropping systems (maize-poppy, urdbean-poppy and groundnut-poppy). On the basis of 3 years poppy in urdbean-poppy cropping system recorded maximum seed (995 kg/ha) and capsule husk (1149 kg/ha) yields. The maximum mean seed (1,048 kg/ha), capsule husk (1,207 kg/ha) and latex (43.58 kg/ha) were obtained with 40 kg P_2O_5/ha applied in both *kharif* and *rabi,* but it was at par with that applied in *rabi* in all 3 years. Further, urdbean-poppy cropping system also had significant higher P-uptake by seed, capsule husk and stover in comparison to maize-poppy and groundnut-poppy. The maximum net returns (Rs 65,334/ha) obtained with the 40 kg P_2O_5/ha in both *kharif* and *rabi* in urdbean-poppy cropping system followed by 40 kg P_2O_5/ha in *rabi* in urdbean-poppy cropping system (Rs 62,606/ha)

Key words : Opium-poppy, Phosphorus, Maize, Urdbean, Groundnut

Opium-poppy (*Papaver somniferum* L.) is an important medicinal crop of Rajasthan. Since the application rates of applied phosphorus are much higher (40-60 kg P_2O_5/ha) as against the crop consumption (10-15 kg/ha), much of the applied phosphorus remains as unutilized residue in the soil (AICM & APRP, 1994). In order to take advantage of such residual phosphorus in opium-poppy—based cropping system, the present investigation was planned.

MATERIALS AND METHODS

The experiment was conducted at Agronomy farm, Rajasthan College of Agriculture, Udaipur, for 3 consecutive years, viz. 1990-91, 1991-92 and 1992-93. The experimental soil was clay loam in texture and having 0.69% organic carbon, 296.0 kg/ha available nitrogen, 67.23 kg/ha available phosphorus and 425 kg/ha available potassium with 8.4 pH. The treatment consisted of 3 cropping system, viz. maize-poppy, urdbean-poppy and groundnut-poppy, and 4 phosphorus application schedule, viz. control, 40 kg P_2O_5/ha in *kharif,* 40 kg P_2O_5 in *rabi* 40 kg P_2O_5/ha in *kharif* and *rabi* both. The

experiment was laid out in randomized block design with 4 replications. In *kharif,* maize 'Ganga 2', urdbean 'T-9' and groundnut were fertilized with 90, 20 and 20 kg N/ha, respectively. Opium-poppy 'JA-16' was sown at 30 cm row to row spacing on 9 November, 31 October and 7 November during 1990-91, 1991-92 and 1992-93 respectively. Application of 90 kg N was done in three splits i.e. $^1/_2$ basal, $^1/_4$ top dressing at 30 days after sowing and $^1/_4$ top dressing at 45 days after sowing. The opium-poppy crop received ten irrigations every year. The lancing of capsule and collection of latex was done in the month of February and plucking of capsule was done in March every year. By and large the weather conditions remained favourable for growing the *kharif* and *rabi* crops in all three years.

RESULTS AND DISCUSSION

Effect of cropping system and phosphorus on poppy

Among the various cropping systems tested, urdbean-poppy cropping system resulted significantly higher seed yield than maize-poppy and groundnut-poppy cropping system during 1990-91 and maize-poppy cropping system during 1991-92 (Table 1). However, during 1992-93, various cropping system did not differ significantly. The mean seed yield increase due to urdbean-poppy cropping system over maize-poppy and groundnut-poppy cropping system was in the order of 13.8 and 18.2 per cent. With regard to capsule husk yield, urdbean-poppy cropping system recorded the maximum yield during all the three years which was significantly superior to maize-poppy and groundnut-poppy during 1990-91 but was at par with maize-poppy during 1991-92. On the basis of mean data, urdbean-poppy cropping system recorded the highest capsule husk yield (1149 kg/ha) which was 5.5 and 7.9 per cent higher over maize-poppy and groundnut-poppy cropping system. The results are in close conformity with those of Jain and Solanki (1993). Higher seed yield after urdbean and groundnut crop could be attributed to biological fixation of N and addition of root mass by legumes, thereby improving physical and chemical properties of soil. These in turns enhanced the opium-poppy productivity is respect of seed yield. Latex yield and morphine content (Table 2) did not show significant variations by various cropping systems in all the three years.

Application of 40 kg P_2O_5/ha in *kharif* caused significant increase in seed yield during 1990-91 and 1991-92 and capsule husk yield during 1991-92 and latex yield only during 1990-91 over control. The mean, capsule and latex yields showed a increase of 12.8, 8.6 and 5.4 per cent, respectively over control. Application of 40 kg P_2O_5/ha in *rabi* and that applied in both *kharif* and *rabi* brought about significant improvement in seed yield during all 3 years, capsule husk yield during 1990-01 and 1991-92 and latex yield during 1990-91. During all 3 years, the maximum seed, capsule & latex yields were obtained with 40 kg P_2O_5/ha applied in both *kharif* and *rabi* but was at par with that applied in *rabi* only. When compared with control, 40 kg P_2O_5/ha in *rabi* increased mean seed, capsule husk and latex yields by 24.6, 18.7 and 20.6 per cent respectively. Jain (1990) also reported significant increase in opium yield with the application of phosphorus. None of the phosphorus

Table 1. Effect of poppy—based cropping system and phosphorus application schedule on seed and capsule husk yields of opium-poppy

Treatment	Seed yield (kg/ha)				Capsule husk yield (kg/ha)			
	1990-91	1991-92	1992-93	Mean	1990-91	1991-92	1992-93	Mean
Cropping system								
Maize-poppy	638	1,043	1,045	908	589	1,293	1,386	1,089
Urdbean-poppy	726	1,103	1,158	995	668	1,336	1,444	1,149
Groundnut-poppy	614	1,094	1,149	952	575	1,207	1,410	1,064
CD (P = 0.05)	52	26	NS		46	90	NS	
Phosphorus								
Control	517	985	952	818	512	1,100	1,318	976
40 kg P_2O_5/ha in *kharif*	587	1,090	1,092	923	550	1,262	1,369	1,060
40 kg P_2O_5/ha in *rabi*	757	1,111	1,190	1,019	668	1,334	1,476	1,159
40 kg P_2O_5/ha in *kharif* and *rabi*	776	1,135	1,235	1,048	715	1,418	1,490	1,207
CD (P = 0.05)	60	30	141		53	104	NS	

Table 2. Effect of poppy based cropping system and phosphorus application schedule on latex yield and morphine content of opium-poppy

Treatment	Latex yield (kg/ha)				Morphine content (%)			
	90-91	91-92	92-93	Mean	90-91	91-92	92-93	Mean
Cropping System								
Maize-poppy	28.76	46.90	44.61	40.09	10.03	10.16	10.30	10.16
Urdbean-poppy	29.99	47.09	45.16	40.74	10.06	10.10	10.28	10.15
Groundnut poppy	28.93	46.86	43.55	39.78	9.96	9.87	10.39	10.07
CD (P = 0.05)	NS	NS	NS		NS	NS	NS	
Phosphorus								
Control	22.82	43.33	41.77	35.97	9.67	10.22	10.25	10.04
40 kg P_2O_5/ha in *kharif*	25.33	43.35	43.02	37.90	9.92	10.12	10.32	10.12
40 kg P_2O_5/ha in *rabi*	34.01	49.64	46.46	43.37	10.12	9.80	10.35	10.09
40 kg P_2O_5 in *kharif* and *rabi*	34.76	49.48	46.50	43.58	10.34	10.09	10.37	10.26
CD (P = 0.05)	2.63	NS	NS		NS	NS	NS	

treatments had any significant effect on morphine content of latex.

Effect on P uptake

Urdbean-poppy cropping system had significant higher P uptake by seed, capsule husk and stover in comparison to maize-poppy and groundnut-poppy cropping system during 1990-91 and 1992-93 (Table 3). Similar were the trend with regard to total

P uptake. On the basis of mean data, the maximum total P uptake (P_2O_5/ha) was recorded with urdbean-poppy system. Application of 40 kg P_2O_5/ha in *kharif* brought about significantly more P uptake by seed, capsule husk and stover during 1990-91 and 1992-93 over control. Application of 40 kg P_2O_5/ha in *rabi* and that applied in both *kharif* and *rabi* resulted significantly higher total P uptake over control as well as that applied in *kharif* only during 1990-91 and 1992-93. On the basis of mean data, application of 40 kg P_2O_5/ha in *rabi* gave 57.6 and 22.2 per cent more total P uptake over control and 40 kg P_2O_5/ha applied in *kharif* respectively.

Economics

Application of 40 kg P_2O_5/ha *in kharif* as well as *rabi* in urdbean-poppy cropping system gave the highest net returns of Rs 65,334/ha followed by Rs 62,606/ha

Table 3. Effect of poppy based cropping system and phosphorus application schedule on P uptake (kg/ha) by opium-poppy

Treatment	Seed		Capsule husk		Stover		Total		
	90-91	92-93	90-91	92-93	90-91	92-93	90-91	92-93	Mean
Cropping System									
Maize-poppy	9.60	13.68	2.14	5.12	2.51	2.93	14.25	21.73	17.99
Urdbean-poppy	12.19	17.48	3.04	5.63	3.57	3.10	18.80	26.21	22.50
Groundnut-poppy	9.32	19.07	2.51	5.78	3.13	3.23	14.96	28.08	21.52
CD (P = 0.05)	0.63	0.56	0.16	0.25	0.22	0.26	1.11	1.20	
Phosphorus									
Control	7.29	12.09	1.68	4.74	1.50	2.30	10.47	19.13	14.80
40 kg P_2O_5 in *kharif*	8.10	16.92	1.99	5.33	2.60	2.94	13.00	25.19	19.09
40 kg P_2O_5 in *rabi*	12.16	18.56	2.77	5.90	3.90	3.35	18.84	27.81	23.32
40 kg P_2O_5/ha in *kharif* and *rabi*	13.70	19.88	3.80	6.25	4.20	3.71	21.70	29.84	25.97
CD (P = 0.05)	0.85	1.50	0.17	0.36	0.28	0.36	1.50	1.97	

Table 4. Effect of application on the net returns of the systems (Average of three years)

Treatments	Net returns (Rs/ha)			Mean
	Maize-poppy	Urdbean-poppy	Groundnut-poppy	
Phosphorus				
Control	41,564	50,570	47,254	46,463
40 kg P_2O_5 in *kharif*	53,336	53,328	52,645	53,103
40 kg P_2O_5 in *rabi*	60,009	62,606	59,356	60,657
40 kg P_2O_5 in *kharif* and *rabi*	61,780	65,334	60,857	62,657
Mean	54,172	57,959	55,028	

obtained in the same system with application of 40 kg P_2O_5/ha in *rabi* (Table 4). Thus, urdbean-poppy cropping system with the application of 40 kg P_2O_5/ha to both crops is more productive, economical and sustainable.

REFERENCES

AICM & APRP 1994. Progress report of AICRP on Medicinal and Aromatic Plants. *All India Workshop held at Kerala Agricultural University., Trichur.* 17 to 20 January, 1994.

Jain, P.M. 1990. Effect of phosphorus and potassium on yield of opium-poppy. *Indian Journal of Agronomy* **35** (3) : 238-239.

Jain, P.M. and Solanki, N.S. 1993. Effect of proceeding crops on fertilizer requirement of opium-poppy (*Papaver somniferum*). *Indian Journal of Agronomy* **38** (1) : 105-106.