

Effect of irrigation schedule and phosphorus on yield attributes and yield of field pea (*Pisum sativum*)

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ABSTRACT

A field experiment was conducted during the winter season of 1988–89 and 1989–90 with 'JP 885' field pea (*Pisum sativum* L. sensu lato) in sandy-clay loam soils at Jabalpur, to determine its irrigation and phosphorus requirement. Application of irrigation at branching and flowering proved promising for higher seed yields mainly due to their beneficial effects on pods/plant, seeds/pod and seed index. The highest seed yield was with 60 kg P_2O_5 /ha, but a dose of 41.19 kg P_2O_5 /ha was found optimum. Phosphorus significantly improved the pods/plant, seeds/pod, pod length and seed index compared with no P, but different doses of P did not differ with each other.

Earlier field pea (*Pisum sativum* L. sensu lato) was mainly grown under rainfed conditions without the use of or rarely any use of P fertilizers. Now dual-purpose varieties, i.e. for seed as well as for green pod, have been evolved. These varieties respond appreciably to management of irrigation and fertilizers. Since interactive effect of irrigation and phosphorus application in the crop is very scanty, present investigation was undertaken on this aspect.

MATERIALS AND METHODS

The field experiment was conducted with field pea at Jabalpur during the winter season (*rabi*) of 1988–89 and 1989–90. The soil of the experimental field had sandy-clay loam texture and pH 7.3. It had low available N (248 kg/ha) and P (3.5 kg/ha), and high K (440 kg/ha). The soil moisture was 17.9% at field capacity and 7.13% at wilting point. The rainfall was 4 and 74 mm

during the 2 crop seasons. Treatments consisted of 8 irrigation schedules, viz. no irrigation, 1 irrigation at branching or flowering or pod-development stage; 2 irrigations, 1 each at branching + flowering or branching + pod development or flowering + pod development; 3 irrigations, 1 each at branching + flowering + pod-development stages as main-plot treatments and 4 phosphorus levels (0, 20, 40 and 60 kg P_2O_5 /ha) as subplot treatments. These were tested in split-plot design with 3 replications. Seeds of 'JP 885' pea were sown on 7 November 1989 and 3 November 1990 with seed rate of 100 kg/ha in rows 30 cm apart. A uniform dose of 20 kg N/ha and 20 kg K_2O /ha was given through urea and muriate of potash respectively. Phosphorus was applied through single superphosphate as basal along with N and K fertilizers. The crop was irrigated by applying measured quantity of water as per treatment. Harvesting of crop

Table 1. Effect of irrigation schedules and phosphorus levels on yield attributes of pea

Treatment	Plant height (cm)		Pods/plant (No.)		Seeds/pod (No.)		Pod length (cm)		Seed index (g)	
	1989	1990	1989	1990	1989	1990	1989	1990	1989	1990
<i>Irrigation at</i>										
Control	79	75	6.1	6.6	3.3	3.3	5.34	5.48	19.9	20.1
B	106	102	7.8	8.9	3.2	3.1	5.42	5.41	19.8	19.9
F	95	90	7.2	8.2	3.1	3.1	5.42	5.44	19.8	20.0
P	92	86	7.3	7.8	3.1	3.0	5.46	5.46	20.5	20.2
B + F	105	100	8.4	8.8	3.1	3.1	5.39	5.78	19.7	19.6
B + P	105	114	8.8	10.0	3.2	3.1	5.48	5.55	20.0	20.0
F + P	98	98	8.6	9.2	3.1	3.2	5.52	5.60	20.5	20.6
B + F + P	109	117	8.8	10.3	3.1	3.0	5.61	5.71	20.2	20.5
CD (P = 0.05)	6.9	6.1	0.38	0.80	NS	NS	NS	NS	NS	NS
<i>P₂O₅ (kg/ha)</i>										
0	95	94	6.6	7.6	3.0	3.0	5.29	5.43	19.9	19.9
20	100	98	8.3	8.7	3.2	3.1	5.46	5.61	20.0	20.2
40	99	97	8.4	9.2	3.2	3.2	5.61	5.72	20.1	20.1
60	100	101	8.2	9.2	3.1	3.1	5.47	5.55	20.1	20.2
CD (P = 0.05)	2.0	2.5	0.28	0.42	0.10	0.08	0.11	0.19	NS	NS

B, Branching; F, flowering; P, pod development; control, rainfed

Table 2. Effect of irrigation schedules and phosphorus levels on seed yield, crop biomass and consumptive use of water in pea

Treatment	Seed yield (q/ha)			Crop biomass (q/ha)			Consumptive water use (mm/ha)		
	1989	1990	Pooled	1989	1990	Pooled	1989	1990	Pooled
<i>Irrigation at</i>									
Control	8.7	8.3	8.5	23.1	21.1	22.1	125.2	130.5	127.9
B	16.1	17.0	16.6	40.7	42.5	41.6	206.7	208.4	207.6
F	12.6	15.9	14.2	33.5	40.5	38.0	213.9	216.7	215.3
P	10.9	11.5	11.2	29.0	28.9	28.9	221.0	224.8	222.9
B + F	17.1	18.4	17.7	45.6	48.5	47.1	263.4	266.2	264.8
B + P	14.5	16.7	15.6	38.2	41.9	40.1	274.6	276.1	275.8
F + P	12.5	13.3	12.9	31.5	32.7	32.1	284.3	285.8	285.1
B + F + P	17.6	17.8	17.7	44.6	43.8	44.2	332.4	337.4	334.9
CD (P = 0.05)	0.5	0.6	0.6	1.8	1.6	1.9	23.7	18.5	
<i>P₂O₅ (kg/ha)</i>									
0	10.1	11.5	10.8	27.3	29.9	28.6	236.8	239.2	237.0
20	14.7	15.7	15.2	38.4	39.5	38.9	242.2	243.1	242.6
40	14.9	15.9	15.4	38.5	40.3	39.4	241.4	244.7	243.0
60	15.3	16.3	15.8	38.9	40.9	39.9	241.7	245.7	243.7
CD (P = 0.05)	0.2	0.4	0.3	0.8	0.6	0.9	NS	NS	

B, Branching; F, flowering; P, pod development; control, rainfed

was done on 27 and 21 February in the 2 consecutive years. Phosphorus-response curve was worked out by using the equation $Y = a + bx + cx^2$ and then optimum dose of P was computed as per Heady and Dhillon (1981).

RESULTS AND DISCUSSION

Effect of irrigation schedule

The treatments receiving irrigation water at various physiological growth stages, viz. branching (40 days after sowing), flowering (60 days) and pod development (80 days), either alone or combined significantly improved plant height and pods/plant compared with no irrigation (Table 1). Other yield determinants, viz. seeds/pod, pod-length and seed index, were not much influenced by different irrigation schedules. Application of irrigation water at branching stage alone or in combination with other stages proved superior to others in respect of yield attributes. As a consequence, both seed and biomass were the least in unirrigated treatment. Yields significantly increased by irrigations (Table 2). The increase in seed yields and biomass was higher when irrigation was given at branching stage alone or in combination with other stages than the other irrigation schedules. While comparing the effect of single irrigation given at 3 different physiological growth stages, irrigation at branching proved promising in respect of yields. Irrigation at flowering stage was next to it. Only 1 irrigation applied at pod development was ineffective, for having been delayed for too long. Likewise, application of irrigation at all the 3 growth stages also did not show any marked effect over 2 irrigations given at branching and flowering stages, indicating that third irrigation was not essential. On the basis of mean data of years, consumptive use of water was minimum with no

irrigation and it increased due to delay in irrigation or increase in irrigation frequencies. Thus, irrigation at branching stage gave relatively higher yields with the use of lesser quantity of water than other irrigation schedules.

Effect of phosphorus level

Phosphorus application greatly increased the plant height, branches/plant, pods/plant, seeds/plant and pod length, but not the test weight (Table 1). The increase was sizeable up to 40 kg P_2O_5 /ha. Improvement in growth and yield characters due to adequate supply of P in P-deficient soils helped increase the yield and crop biomass up to 60 kg P_2O_5 /ha, but differences beyond 40 kg P_2O_5 /ha were not remarkable (Table 2). Pooled data of both years showed seed yield and crop biomass 10.8 and 28.6 q/ha at no phosphorus, which increased by with an increase level of P respectively. The relationship of seed yield and P levels was quadratic in nature and the equation observed on pooled data was:

$$y = 11.0199 + 0.2260 P - 0.0025 P^2$$

($R_2 = 94.15\%$)

The optimum economic dose of P was 41.19 kg/ha. Consumptive use of water did not vary with different doses of P. Ingole and Deshmukh (1986) and Kanwar *et al.* (1989) also reported similar results.

REFERENCES

- Heady, E. O. and Dhillon, J. L. 1981. *Agriculture Production Functions*. Iowa State University of Iowa, Ames, the USA.
- Ingole, G. L. and Deshmukh, V. A. 1986. Response of gram, pea and lentil to phosphorus under irrigated conditions in sequence of Kharif paddy. *Punjabrao Krishi Vidyapeeth Research Journal* 10 (1) : 16-18.
- Kanwar, J. S., Saimbhi, M. S. and Chadda, M. L. 1989. Seed yield in pea as influenced by spacing and phosphorus levels. *Research Development Reporter* 6 (2) : 63-65.