

## RESPONSE OF COWPEA TO IRRIGATION AND PHOSPHORUS

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**Abstract:** Investigations carried out in the rice fallows of the Agronomic Research Station, Chalakudy revealed that grain and green pod yields of cowpea variety Kanakamani were significantly increased by irrigation and application of phosphorus. Irrigation at critical stages of branching, flowering and pod formation and irrigation at  $1W/CPE = 0.75$  were better schedules for the production of grain and green pods. The economic optimum dose of phosphorus was worked out to 30.0 and 36.8 kg  $P_2O_5$  ha<sup>-1</sup> for the production of grain and green pods, respectively.

**Key words:** Cowpea, irrigation, P nutrition

### INTRODUCTION

Cowpea (*Vignasinensis savi*) is widely grown for its green pods and dry seeds. In Kerala it is raised as rainfed during monsoon and irrigated during post-monsoon seasons. Rice fallows with limited irrigation facilities offer scope for its cultivation in Kerala. Growth and yield of cowpea are reported to be highly influenced by irrigation during periods of high consumptive use (Singh *et al.*, 1975; Ahlawat *et al.*, 1979; Lawn and Williams, 1986). Workers like Singh and Lamba (1971), Malik *et al.* (1972), Sharma (1978) and Ahlawat *et al.* (1979) have reported that cowpea responds well to phosphorus application. Information on irrigation and phosphorus requirement of the crop raised in rice fallows is lacking. Investigations were therefore carried out to find out the response of cowpea to irrigation and phosphorus.

### MATERIALS AND METHODS

Experiments were laid out in the rice fallows of the Agronomic Research Station, Chalakudy during dry months (January to April) of 1985 and 1986. The soil type was riverine alluvium and was sandy loam in texture with field capacity 15.2%, permanent wilting point 7.1%, bulk density 1.44 g cm<sup>-3</sup>, pH 5.9 and EC 0.34 dS m<sup>-1</sup>. The contents of organic carbon, available  $P_2O_5$  and available  $K_2O$  were 0.64%, 10.7 kg ha<sup>-1</sup> and 39.7 kg ha<sup>-1</sup> respectively. The depth of water table ranged from 80 to

170 cm. The crop received a rainfall of 34.1 mm in 1985 and 106.1 mm in 1986 in five and nine rainy days, respectively.

Treatments comprising five levels of irrigation viz., IW/CPE ratios 0.25 ( $I_1$ ), 0.50 ( $I_2$ ), 0.75 ( $I_3$ ) and 1.00 ( $I_4$ ) and irrigation at critical stages of branching, flowering and pod formation ( $I_5$ ) and four levels of phosphorus viz., no phosphorus ( $P_0$ ), 15 kg  $P_2O_5$  ha<sup>-1</sup> ( $P_1$ ), 30 kg  $P_2O_5$  ha<sup>-1</sup> ( $P_2$ ) and 45 kg  $P_2O_5$  ha<sup>-1</sup> ( $P_3$ ) were laid out in a factorial RBD with three replications. The depth of irrigation was 50 mm. Seeds of the test variety Kanakamani were dibbled at a spacing of 25 cm x 15 cm after a pre-sowing irrigation. A uniform dose of 20 kg N and 10 kg  $K_2O$  ha<sup>-1</sup> was applied to all the plots besides 250 kg lime. Each plot having a size of 6 m x 3 m was divided into two equal halves for collecting grain and green pods separately.

### RESULTS AND DISCUSSION

Irrigation and phosphorus exerted significant influence on grain and green pod yield during both the seasons (Table 1). Among the irrigation treatments the highest grain yield was recorded by  $I_4$  (IW/CPE = 1) which was statistically on par with  $I_3$  (IW/CPE = 0.75) and  $I_5$  (critical stage irrigation). These three treatments were significantly superior to  $I_1$  and  $I_2$  which were on par with each other. The green pod yield, however, increased significantly with successive increase in the level of irrigation up to  $I_3$ . The treatments

$I_3$ ,  $I_4$  and  $I_5$  were statistically on par during 1986 and in the pooled mean. Among these three treatments,  $I_5$  (irrigation at critical stages) requiring four irrigations and  $I_3$  ( $IW/CPE = 0.75$ ) requiring 4 to 5 irrigations at an interval of 16 to 18 days (Table 2) proved to be better schedules for the production of grain as well as green pod in

cowpea. The percentage increase in grain yield at  $I_5$  and  $I_3$  over  $I_1$  was 15.9 and 19.1, respectively. Corresponding increase in green pod yield was 46.8 and 52.0 per cent respectively. The result also indicated the profound influence of irrigation during dry months in increasing the yield of green pod as compared to grain in cowpea.

Table 1. Effect of irrigation and phosphorus on the grain and pod yield of cowpea

Treatments	Grain yield, kg ha <sup>-1</sup>			Green pod yield, kg ha <sup>-1</sup>		
	1985	1986	Mean	1985	1986	Mean
Irrigation						
$I_1$	816	1310	1063	4473	5841	5157
$I_2$	832	1335	1084	5262	7629	6446
$I_3$	1019	1514	1267	6021	9663	7842
$I_4$	1062	1541	1302	6079	10253	8166
$I_5$	980	1482	1231	5670	9675	7673
CD(0.05)	145	90	127	265	760	693
Phosphorus						
$P_0$	856	1331	1094	5153	7536	6345
$P_1$	906	1452	1179	5265	7922	6594
$P_2$	1037	1522	1279	5878	10041	7954
$P_3$	968	1441	1205	5709	8950	7324
CD(0.05)	134	101	114	273	848	685

The grain and green pod yield due to phosphorus application was positive and significant up to  $P_2$  level. Beyond that there was a slight reduction in yield. Grain yield obtained at  $P_2$  (30 kg  $P_2O_5$  ha<sup>-1</sup>) was significantly superior to  $P_0$  (no phosphorus) and statistically on par with  $P_1$  (15 kg  $P_2O_5$ ) and  $P_3$  (45 kg  $P_2O_5$  ha<sup>-1</sup>). In the case of green pod,  $P_2$  recorded the highest

mean yield of 7954 kg ha<sup>-1</sup> which was significantly higher than that of  $P_0$  and  $P_1$  which were on par with each other.

Among the growth and yield characters the number of branches per plant, the length of pod and the number of grains per pod were significantly influenced by irrigation and phosphorus. The nature of

response obtained in the length of pod and number of grains per pod was almost similar to that obtained in the yield of green pod and grain respectively.

The response function to phos-

phorus application was quadratic in nature. The response equations for grain and green pods were:

$$\text{Grain : } Y = 1084.36 + 10.838P - 0.177P^2$$

$$\text{Green pod : } Y = 6186.45 + 73.297P - 9.922P^2$$

Table 2. Details of irrigation

Treatments	Number of irrigations		Total quantify of water applied (mm)		Mean interval between irrigations	
	1985	1986	1985	1986	1985	1986
I1	2	3	100	150	45	40
I2	3	4	150	200	26	22
I3	4	5	200	250	18	16
I4	5	6	250	300	11	14
I5	4	4	200	200	-	-

\*Including pre-sowing irrigation

The optimum dose of  $P_2O_5$  giving the maximum yield was worked out to be  $30.7 \text{ kg ha}^{-1}$  for grain and  $36.9 \text{ kg ha}^{-1}$  for green pod, respectively. The levels giving maximum profit were  $30.4 \text{ kg}$  and  $36.8 \text{ kg } P_2O_5 \text{ ha}^{-1}$ , respectively at a price of Rs 7 per kg grain, Rs 3 per kg green pod and Rs 5.90 per kg  $P_2O_5$ .

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