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RESPONSE OF COWPEA (*VIGNA UNGUICULATA* (L.) WALP.) TO WATER MANAGEMENT PRACTICES AND PHOSPHORUS NUTRITION

Summer season pulses account for about 40 per cent of the area under these crops in Kerala which are raised mainly depending on the residual moisture and the scarcity of water is a major production constraint. Among the pulses cultivated in the state, cowpea is by far the most important. To effectively utilise the scarce moisture available during summer, a judicious schedule of irrigation to this crop has to be worked out. The present investigation was undertaken to study the response of cowpea to water management practices and phosphorus nutrition in summer rice fallows.

A field experiment was conducted in the sandy loam soils of the Agronomic Research Station, Chalakudy during the summer season (January to April) as a factorial experiment in randomised block design with six levels of water management, three levels of phosphorus and three replications. The levels of water management consisted of irrigation scheduled at IW/CPE ratios of 1.00, 0.75, 0.50 and 0.25 and at mixed ratios (0.30, 0.50, 0.75 and 0.60 at first, second, third and fourth quarters of crop growth, respectively) and at critical stages (branching, flowering and pod formation stages). The evaporation reading from USWB class A open pan evaporimeter was recorded daily and whenever the ratio of irrigation water (IW) to cumulative pan evaporation reading (CPE) minus rainfall equalled the treatment ratios, irrigation was given at a depth of 30 mm during the first quarter of growth, and at 40 mm during the later stages to the respective irrigation treatments. The quantity of irrigation water was measured using a circular orifice plate. The details of irrigation given are presented in Table 1. The levels of phosphorus consisted of application of 30, 50 and 70 kg P_2O_5/ha. Lime was applied uniformly at the rate of 250 kg/ha during the final land preparation. A uniform dose of 20 kg N and 10 kg K_2O was also applied. Half the amount of N, entire quantity of P_2O_5 and K_2O were applied basally. The remaining amount of N was applied as 2% foliar spray of urea on the 21st and 27th day after sowing. The seeds of cowpea cv. Kanakamani (Ptb 1) were dibbled at a spacing of 30 cm x 20 cm at a depth of 3 to 5 cm. The crop was weeded once and was harvested in three pickings.

Growth attributes

The direct effects of the levels of water management as also of phosphorus on the height of plant and number of leaves per plant were not significant. Water management levels did not affect the number of branches also but phosphorus significantly increased this character. Both leaf area index and dry matter accumulation were significantly increased by increase in moisture supply but phosphorus had very little influence on these characters.

Increasing the moisture supply caused an increasing trend in plant height and number of branches. Application of five or more irrigations effected a significant increase in the leaf areas index and dry matter accumulation. Reduced leaf expansion and consequent reduction in photosynthesis due to moisture stress created when the crop was given less than five irrigations

Table 1. Details of irrigation given to the crop

IW/CPE ratio	Total No. of irrigations	Irrigation water applied (mm)	Irrigation water plus rainfall received (mm)	Mean irrigation interval (days)
1.00	10	360	416.2	7.6
0.75	7	250	306.2	10.3
0.50	5	180	236.2	15.8
0.25	3	110	166.2	33.0
Mixed ratio	5	190	246.2	15.8
Critical stages	4	140	196.2	–

Table 2. Yield and yield attributes of cowpea as affected by the treatments

Treatments	No. of pods per plant	No. of seeds per pod	Length of pod (cm)	100 grain weight (g)	Yield of haulm (g/ha)	Yield of grain (g/ha)
Irrigation at IW/CPE ratio of						
1.00	6.00	13.96	16.66	10.837	22.40	8.12
0.75	6.70	14.39	16.61	11.184	19.75	9.31
0.50	6.14	14.34	16.63	11.371	18.61	9.07
0.25	4.56	13.66	16.25	11.087	16.51	7.14
Mixed ratio	5.79	13.84	16.22	11.590	20.75	9.49
Critical stages	5.35	13.76	16.17	10.784	18.37	6.69
CD (0.05)	0.746	NS	NS	NS	2.143	0.91
SEM ±	0.367	–	–	–	1.054	0.45
P_2O_5 kg/ha						
30	5.47	13.92	16.68	10.731	18.46	7.51
50	6.00	14.12	16.33	11.311	18.87	8.81
70	5.81	13.93	16.26	11.381	20.84	8.59
CD (0.05)	NS	NS	NS	0.480	1.50	0.65
SEM ±	–	–	–	0.236	0.74	0.32
I x P interaction effect	Sig	NS	NS	Sig	NS	Sig

might have resulted in this situation. The effect of phosphorus was more pronounced on the number of branches which increased with successive additions and the difference between 30 and 70 kg P_2O_5/ha reached the level of significance. LAI and dry matter accumulation also showed a clear trend of increase with increase in the rates of phosphorus applied.

Yield and yield attributes

The direct effects of water management and phosphorus on the yield of grain and haulm were significant. The effect of water management on the number of pods and that of phosphorus on the test weight of 100 grains was also significant. Irrigations at the mixed ratio (receiving 190 mm

Table 3. Interactin effect of irrigation and phosphorus levels on the yield and yield attributes.

Irrigation at IW/CPE ratio of	No. of pods per plant			100 grain weight (g)			Yield of grain (g/ha)		
	P_2O_5 kg/ha			P_2O_5 kg/ha			P_2O_5 kg/ha		
	30	50	70	30	50	70	30	50	70
1.00	5.84	6.05	6.13	10.29	11.53	10.67	7.61	7.73	9.02
0.75	6.34	7.00	6.75	10.83	11.30	11.41	8.28	9.15	10.50
0.50	5.05	6.75	6.63	10.47	11.57	12.06	6.87	10.28	10.07
0.25	4.63	4.80	4.25	10.43	12.00	10.80	7.19	7.71	6.51
Mixed ratio	5.92	6.00	5.46	11.68	10.45	12.62	8.41	10.55	9.49
Critical stages	5.05	5.38	5.63	10.66	10.99	10.69	6.68	7.44	5.94
CD (0.05)									
I x P interaction effect		1.293			1.175			1.592	
SEM ±		0.636			0.578			0.783	

vater in five irrigations) recorded the naximum grain yield but was on par vith ratio of 0.75 and 0.50, all of them)eing significantly superior over the)ther levels. Irrigation schedules at the 'atios of 0.75, 0.50 and 1.00 produced ignificantly higher number of pods per)lant also. Reduced flower and fruit set ınd flower and early fruit abscision ınder water stress might have decreased)od production in the less frequent rrigation schedules (Kaufmann, 1972). The substantially higher number of pods >er plant in the ratios of 0.75 and 0.50 ınd the high test weight of 100 grains n the mixed ratio might have together :ontributed to the higher grain yields in hese treatments. The LAI and dry natter accumulation were also better in hese treatments. Though the ratio of ..00 also recorded higher number of)ods, it recorded a low test weight. The ield of haulms increased progressively vith increase in moisture supply, the 'atio of 1.00 recording the highest haulm ield. Among the three schedules iving high grain yields, that at the ratio)f 0.50 which required the least quantity)f irrigation water may be considered suitable for cowpea.

The yield of grain increased significantly by the application of 50 kg P_2O_5/ha but it was on par with 70 kg level. Singificant yield increase in cowpea due to phosphorus application has been reported by sharma and Garg (1973) and Kunju *et al*. (1976). The test weight of grains also increased significantly under the higher levels of phosphorus which might have contributed to the yield increase in these treatments. The yield of haulm also progressively increased with increase in phosphorus application, 70 kg P_2O_5/ha recording the maximum haulm yield. It was found that the quadratic funcion was the best fit for the relationship between phosphorus applied and the yield of grain. The optimum dose of phosphorus for maximum grain yield was found to be 57.1 kg P_2O_5/ha while the optimum economic dose was found to be 56.6 kg P_2O_5/ha. The interaction effect, between the levels of irrigation and phosphorus was significant on the number of pods, test weight of 100 grains and the yield of grain.

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