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RESPONSE OF VEGETABLE COWPEA TO NITROGEN AND POTASSIUM UNDER VARYING METHODS OF IRRIGATION

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Abstract: An experiment on vegetable cowpea *Vigna unguiculata* subsp. *sesquipedalis*) with three methods of irrigation (surface irrigation at 20 mm CPE with 40 mm water, irrigation at 10 mm CPE with 20 mm water through micro-sprinkler and farmer's practice of daily pot watering with 10 mm water) and three levels each of nitrogen and potassium (0, 20 and 40 kg ha^{-1}) was conducted in the sandy clay loam soils of the Instructional Farm of the College of Agriculture, Trivandrum during the summer season of 1999. Irrigating the crop with 20 mm water through micro-sprinkler resulted in significantly higher green pod yield as compared to the other two methods. The crop response to nitrogen and potassium was positive up to 20 kg ha^{-1}.

Key words: Vegetable cowpea, irrigation, nitrogen and potassium

INTRODUCTION

Among the vegetable crops grown in Kerala, vegetable cowpea occupies a prime position. During summer season, it is cultivated as an irrigated crop in the uplands or in rice fallows. Scarcity of irrigation water is the major yield-limiting factor in the summer cowpea. Even though cowpea, a leguminous crop, has the ability to fix atmospheric nitrogen, it requires a starter dose of nitrogen for early growth and establishment (Russell, 1961). The functions of potassium in plant-water relations are well documented. It usually helps to overcome the moisture stress experienced by crops. As harvesting is protracted in vegetable cowpea, its response to irrigation and nutrients may vary from that of grain cowpea. In this background, an attempt was made to study the effect of nitrogen and potassium at different growth stages of the crop under varying methods of irrigation.

MATERIALS AND METHODS

The field experiment was conducted at the Instructional Farm, College of Agriculture, Vellayani, Trivandrum during the summer season of 1999. The soil of the experimental area was sandy clay loam having a bulk density of 1.34 g/cc and a pH of 5.1. It contained 232.5, 32.8 and 52.4 kg ha^{-1} of available N, P_2O_5 and K_2O, respectively. The field capacity and permanent wilting point were 24.6 and 13.2 per cent, respectively.

The treatments consisted of three methods of irrigation (I_1 - Irrigation at 20 mm CPE with

Table 1. Weather data during the cropping period of 1999

Standard week	Max. temp.,°C	Mini. temp.,°C	Total rainfall, mm	Evaporation, mm/week	Mean RH,%
3	31.3	22.5	0	25.1	92.5
4	31.4	21.3	0	15.9	77.4
5	30.6	21.4	2.0	24.7	76.3
6	30.9	22.3	78.6	27.8	83.0
7	31.4	23.1	0	26.4	81.6
8	31.8	23.1	0	26.4	84.4
9	31.9	23.1	0	27.8	80.0
10	32.2	23.1	0	30.2	78.8
11	32.7	24.3	1.8	30.4	80.7
12	32.5	25.2	54.2	31.6	81.2
13	32.7	25.3	2.2	28.2	82.0
14	32.4	24.9	0	29.6	80.7
15	32.3	25.1	29.1	31.1	81.1
16	32.0	25.4	0.9	28.4	82.6
17	29.1	24.0	110.8	19.1	87.6

40 mm water through surface method, I_2 - Irrigation at 10 mm CPE with 20 mm water through micro-sprinklers, I_3 - Farmer's practice of daily irrigation with 10 mm by pot watering), three levels of nitrogen (N_1 - 0 kg ha^{-1}, N_2 - 20 kg ha^{-1} and N_3 - 40 kg ha^{-1}) and three levels of potassium (K_1 - 0 kg ha^{-1}, K_2 - 20 kg ha^{-1}, K_3 - 40 kg ha^{-1}). The experiment was laid out in 3^3 confounded factorial experiment, confounding INK in first replication and INK^2 in second replication. The test variety was Malika, which was sown at a spacing of 100 x 60 cm.

Table 2. Effect of irrigation, nitrogen and potassium on yield and yield attributing characters

Treatments	Days to 50% flowering	No. of pods / plant	Pod yield, kg ha^{-1}	Haulm yield, kg ha^{-1}
Irrigation				
I_1	45.2	52.1	8674	16637
I_2	39.2	60.4	10059	16214
I_3	42.3	51.7	8623	16829
SE_D		2.7	349	406
CD (0.05)	1.2	5.6	724	NS
Nitrogen				
N_1	42	51.5	8589	16929
N_2	42.6	57.0	9487	16294
N_3	42.1	55.7	9280	16456
SE_D	—	2.7	349	406
CD (0.05)	NS	NS	724	NS
Potassium				
K_1	41.5	56.4	9391	16596
K_2	42.7	57.2	9520	16516
K_3	42.5	57.2	8444	16567
SE_D	—	2.7	349	406
CD (0.05)	NS	NS	724	NS

FYM @ 20 t ha^{-1} was applied uniformly to all the plots and mixed well with topsoil. A common dose of phosphorus @ 45 kg ha^{-1} (Mini, 1997) was given to all treatments. Full dose of phosphorus and potassium and half dose of nitrogen were applied as basal and the remaining nitrogen in three equal split doses at 20, 30 and 40 days after sowing as soil application. Irrigation was scheduled to the crop one week after sowing onwards as per the treatments. Measured quantities of water were given to the plots according to the treatments.

RESULTS AND DISCUSSION

Pod yield and haulm yield

The data on pod and haulm yield revealed that the differential levels of irrigation had significant influence on green pod yield. The irrigation level at I_2 registered significantly superior pod yield over the other two levels. Nitrogen and potassium also exerted profound influence on green pod yield. The main effects of I, N and K were not significant in the case of haulm yield. Better performance of micro-sprinkler method of irrigation was probably due to the favourable micro-climatic conditions, availability of uniform and adequate moisture for plant growth and keeping the soil structure loose and friable which was conducive to good aeration resulting in the better growth and partitioning of DMP (Dabhi *et al.*, 1998). Though the total quantity of irrigation water used was less, due to better application efficiency the micro-sprinkler irrigated plot gave maximum yield. The haulm yield though not significant, was greater in daily light-irrigated treatment, which indicated the better vegetative growth of the crop without any concomitant increase in pod yield. Higher level of nitrogen above N_2 tended to reduce

Table 3. Interaction effect of irrigation and nitrogen on net return and benefit cost ratio

Treatments	Net returns (Rs ha^{-1})	Benefit-cost ratio
I_1N_1	42566	1.3
I_1N_2	49109	1.5
I_1N_3	39928	1.2
I_2N_1	41259	0.9
I_2N_2	38110	0.8
I_2N_3	63529	1.5
I_3N_1	42952	1.3
I_3N_2	50712	1.5
I_3N_3	35582	1.0
SE_D	—	0.2

the pod yield. The reduction in yield at higher dose of nitrogen might be due to the excessive vegetative growth at the expense of pod production. Potassium at 20 kg ha^{-1} gave the maximum yield indicating the possibility of higher requirement of K for vegetable cowpea due to staggered pattern of harvesting.

Yield attributing characters

The main yield attributing characters for vegetable cowpea are the number of pods per plant and days to 50 per cent flowering. It was found that differential irrigation significantly influenced the days to 50 per cent flowering. The treatment I_2 attained 50 per cent flowering earlier and recorded maximum number of pods per plant. Both N and K did not have any marked influence on these yield-attributing characters. A higher level of available moisture in the soil might have maintained better soil-plant water balance in I_2 and hence exhibited maximum number of pods and earliness in flowering.

Economics of cultivation

The main effects showed no marked variation on the returns and benefit cost ratio whereas the interaction between I x N significantly influenced the economics of cultivation. In the case of net returns, the combination I_2N_3 recorded the highest value. The treatment I_1N_2 gave the highest benefit cost ratio. Interaction between I x K and N x K did not have any influence on the economics of cultivation. The maximum net profit recorded by I_2N_3 might be due to the highest yield of pods recorded by this treatment. The reduction in benefit cost ratio might be due to high cost of installation in the case of sprinkler method.

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REFERENCES

Dabhi, B.M., Patel, J.C. and Solanki, R.M. 1998. Response of summer green gram to irrigation methods and varying moisture regimes. *Legume Res.* 21: 96-100

Mini, C.L. 1997. Response of vegetable cowpea (*Vigna sesquipedalis* (L) Fruw) to phosphorus under varying moisture levels and plant density. M.Sc.(Ag.) thesis, Kerala Agricultural University, Trichur, pp. 165

Russell, E.W. 1961. *Soil Conditions and Plant Growth* 9th ed., Longmans Green and Co., London, pp. 530