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Influence of Irrigation Scheduling Based on IW: CPE Ratio and Levels of Sulphur on Growth and Yield of *Rabi* Greengram [*Vigna radiata* (L.) Mills]

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A field experiment was conducted at Regional Research Station, Anand Agricultural University, Anand, Gujarat to study the influence of irrigation scheduling based on IW: CPE ratio and levels of sulphur on performance of greengram [*Vigna radiata* (L.) Mills] during *rabi* season of the year 2010-11. Higher values of growth characters and yield attributes, seed and straw yield were recorded under irrigation treatment I_3 (0.8 IW: CPE ratio). Each sucessive increase in the levels of sulphur from 0 to 40 kg ha^{-1} significantly increased the growth and yield attributes as well as seed and haulm yield. Higher net realization and BCR ha^{-1} were recorded under irrigation treatment I_3 (0.8 IW: CPE ratio) and 40 kg S ha^{-1}

Keywords: Irrigation, IW: CPE ratio, Sulphur, Greengram and Yield.

Among the pulses, greengram (*Vigna radiata* L.) is one of the most important and extensively cultivated pulse crops. Greengram, commonly known as "mung" or "mungbean", is recognized as an excellent source of protein. It also plays an important role in maintaining and improving the soil fertility by atmospheric nitrogen fixation through root nodules. Nodule formation on the root of greengram having Rhizobium bacteria fix about 35 kg ha^{-1} atmospheric nitrogen (Gupta and Prasad, 1982) and make it available to the growing cereal crops either in mixed or in the rotation cropping which is subsequently beneficial to the succeeding crop (Yadav, 1992).

In India, greengram is cultivating about 3 million ha with total production of 0.25 million tonnes with average productivity of 546 kg ha^{-1} (Anon., 2010). Yield of greengram is low as its cultivation is mainly confined under rainfed condition and in poor textured soil. Because of the short duration and adjustability under different cropping systems or situations, greengram have enormous potential in future which needs to be capitalized. Greengram is predominant in *kharif* and summer seasons, but also cultivated for last few years in *rabi* season in several part of India as a post rainy season crop taken as intercrop with sorghum. The yield level of *rabi* greengram is high as compared to *kharif*, because of minimum biotic and abiotic stresses (Anon., 2004).

Among various factors known to augment crop production, irrigation, fertilizers and high yielding varieties are the major inputs playing pivotal role in increasing greengram production. Therefore, proper management of irrigation water is highly essential for successful cultivation of *rabi* greengram.

Continuous use of sulphur - free fertilizers, intensification of agriculture with high yielding crop varieties and use of lesser amount of organics resulted in sulphur deficiency in crops. Sulphur is generally called the fourth major nutrient. Requirement of sulphur is just slightly less than phosphorus. Sulphur plays an important role in synthesis of protein, vitamins, S-containing

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essential amino acids (Methionine, Crystine and Cysteine), in promotion of root nodulation and also in growth and development of crops. Keeping above aspects in view, the present study was carried out to know the influence of irrigation scheduling based on IW: CPE ratio and levels of sulphur on growth and yield of *rabi* greengram.

MATERIALS AND METHODS

An experiment was conducted at Regional Research Station, Anand Agricultural University, Anand (Gujarat) to study the influence of irrigation scheduling based on IW: CPE ratio and levels of sulphur on performance of greengram [*Vigna radiata* (L.) Mills] during *rabi* season of the year 2010-11. The soil of experimental field was sandy loam in texture, having low in organic carbon (0.39 %), available nitrogen (190.10 kg ha^{-1}) and medium in available phosphorus (42.50 kg ha^{-1}) and available potash (315.86 kg ha^{-1}). The treatments comprising four levels of irrigation I_1 (0.4 IW: CPE ratio), I_2 (0.6 IW: CPE ratio), I_3 (0.8 IW: CPE ratio) and I_4 (critical growth stages) in main plot and three levels of sulphur *viz.*, S_0 (0 kg S ha^{-1}), S_1 (20 kg S ha^{-1}) and S_2 (40 kg S ha^{-1}) in sub plot were tested in split plot design with four replications using greengram variety cv. CO 4. Irrigation water of 50 mm (measured with the help of parshall flume) was allowed to run in each plot at each irrigation. Nitrogen and phosphorus were supplied through urea and DAP, respectively. Sulphur was applied as per treatment in the form of gypsum. N (20 kg ha^{-1}) and P (40 kg ha^{-1}) were applied at basal and mixed with the soil of the individual plots. Crop was harvested in the third week of February. The data recorded during the course of investigation were subjected to statistical analysis as per method of analysis of variance (Panse and Sukhatme, 1967). Greengram was sown on 20 October with seed rate of 20 kg ha^{-1}.

RESULTS AND DISCUSSION

Effect of irrigation

Data presented in Table 1 indicated that application of irrigation at 0.8 IW: CPE ratio recorded significantly higher plant height (49.78 cm), the highest number of branches $plant^{-1}$ (3.44) and the highest dry weight of root nodules (28.25 mg). These might be due to more availability of essential nutrients under irrigated conditions, which resulted into balance nourishment of plants and the formation of taller, thicker stem and root system ultimately increased number of branches $plant^{-1}$ and dry weight of root nodules. Other reason for increased number of branches $plant^{-1}$ is maintenance of higher plant water status and cooler canopy which resulted into more absorption of photosynthetically active radiation and higher rate of photosynthesis (Pal and Lal, 1993 and Kavitha and Wahab, 2001).

Further data revealed that number of pods $plant^{-1}$(31.17), length of pod (6.15 cm), number of seeds pod^{-1} (9.59) and test weight of 100 seed (5.98 g) were significantly higher under irrigation at 0.8 IW: CPE ratio. The reason for increasing these yield attributes characters was frequent water supply and higher amount of water to the soil that resulted in increasing uptake of water and provided the longest reproductive phase with larger photosynthetic green surface and reproductive storage capacity to attain higher allocation of dry matter in seed. The present finding is in close agreement with those reported by Idnani and Gautam (2008).

Application of irrigation at 0.8 IW: CPE ratio (I_3) recorded significantly the highest seed yield (1417 kg ha^{-1}) and higher straw yield (2783 kg ha^{-1}). The increase in seed yield might be due to increase in irrigation frequency and consumptive use because of increased number of irrigations. Thus, progressive increases in seed yield due to favourable soil moisture conditions and better availability of soil moisture at higher frequency of irrigation throughout the crop growth period, which remarkably stimulated the yield attributes and finally seed and straw yields. The present finding are inclose agreement with those reported by Trivedi *et al.* (1994), Dabhi *et al.* (2000) and Bhadoria and Bhadoria (2002).

Effect of sulphur

Application of 40 kg S ha^{-1} recorded significantly the highest plant height (49.06 cm), higher number of branches $plant^{-1}$ (3.15) and dry weight of root nodules (21.81 mg). The increased in plant height and dry weight of root nodules might be due to the beneficial effect of sulphur on various metabolic activities and also play important role in cell division, photosynthesis process and

Table 1. Effect of irrigation and sulphur on growth and yield attributing characters, yield and economics of greengram

Treatments	Plant height (cm)	No. of branches plant^{-1}	Dry weight of root nodules (mg)	No. of pods plant^{-1}	Length of pod (cm)	No. of seeds pod^{-1}	Test weight (g)	Seed yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Net realization (Rs. ha^{-1})	BCR
Irrigation (I) at											
I_1	42.97	2.68	15.42	27.81	5.44	7.67	5.38	1128	2369	50389	2.56
I_2	47.37	2.99	23.63	29.81	5.73	8.35	5.70	1274	2619	58755	2.90
I_3	49.78	3.44	28.25	31.17	6.15	9.59	5.98	1417	2783	66855	3.19
I_4	46.52	2.76	17.21	29.52	5.68	7.86	5.63	1236	2551	57051	2.90
S. Em. +	1.43	0.10	0.61	0.60	0.13	0.28	0.13	44	83	-	-
C. D. at 5 %	4.58	0.33	1.95	1.92	0.43	0.90	0.40	141	266	-	-
C. V. %	10.62	11.95	10.00	7.03	8.01	11.62	7.69	12.07	11.18	-	-
Sulphur (S) (kg ha^{-1})											
S_0: 0 kg S ha^{-1}	45.00	2.79	20.38	28.14	5.54	7.87	5.32	1205	2506	57722	3.35
S_1: 20 kg S ha^{-1}	45.91	2.96	21.19	29.36	5.75	8.42	5.71	1263	2603	61135	3.54
S_2: 40 kg S ha^{-1}	49.06	3.15	21.81	31.23	5.96	8.81	5.99	1323	2633	64600	3.71
S. Em. +	0.85	0.07	0.35	0.49	0.11	0.21	0.08	31	64	-	-
C. D. at 5 %	2.48	0.21	1.03	1.42	0.31	0.61	0.24	91	NS	-	-
Interaction											
I X S	NS	NS	NS	NS	NS	NS	NS	NS	NS	-	-
C. V. %	7.27	9.66	6.69	6.60	7.46	10.04	5.73	9.83	9.93	-	-

formation of chlorophyll in leaf. The increase in number of branches plant^{-1} might be due to sulphur is a part of amino acid (Cystine), which helps in chlorophyll formation, photosynthetic process (Singh *et al.*, 2004 and Yadav, 2004).

The presented result revealed that sulphur application @ 40 kg S ha^{-1} recorded significantly the highest number of pods plant^{-1}(31.23), higher length of pod (5.96 cm), number of seeds pod^{-1} (8.81) and highest test weight of 100 seed (5.99 g). Increase in different yield attributes characters might be due to sulphur which is a part of amino acid (Cystine and Methionine) and helps in chlorophyll formation, photosynthetic process, activation of enzymes and seed formation (Karwasra and Raj, 1984 and Bhadoria *et al*,. 1997).

Significantly higher seed yield (1323 kg ha^{-1}) was recorded under treatment S_2 (40 kg S ha^{-1}). The increased in seed yield under treatment S_2 (40 kg S ha^{-1}) was to the tune of 4.75 and 9.79 per cent over sulphur levels S_1 (20 kg S ha^{-1}) and S_0 (0 kg S ha^{-1}), respectively. The higher yield with sulphur application could be ascribed to accelerated nutrients uptake helped the plant to put optimum growth. The stimulatory effect of applied sulphur on the synthesis of chloroplast and protein which in turn promoted greater photosynthesis ultimately resulted in higher seed yield (Kaprekar *et al.*, 2003 and Singh *et al.*, 2004).

Interaction effect (IXS)

Interaction effect between irrigation scheduling and sulphur levels was found to be non-significant to all the parameters.

Economics

From the presented data in Table -1 revealed that treatment I_3 (0.8 IW: CPE ratio) recorded higher net realization (66855 Rs. ha^{-1}) with BCR 3.19 and application of 40 kg S ha^{-1} recorded higher net realization (64600 Rs. ha^{-1}) with BCR 3.71.

CONCLUSION

From the above study it can be concluded that for securing higher seed yield and net realization from *rabi* greengram variety cv. CO 4 grown on sandy loam soil it is advisable to apply irrigation at 0.8 IW: CPE ratio and sulphur @ 40 kg ha^{-1}.

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