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EFFECT OF SCHEDULING IRRIGATION AND ORGANIC MANURE ON YIELD ATTRIBUTES, NUTRIENT CONTENT AND UPTAKE OF RABI AMARANTHUS (*Amaranthus Paniculatus L.*) IN SAURASHTRA REGION

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Abstract: A field experiment was conducted during winter (*rabi*) season of 2011-2012 at instruction farm, Department of Agronomy, Junagadh Agricultural University, Junagadh to evaluate the effect of scheduling irrigation and organic manure on yield attributes, nutrient content and uptake of rabi under Saurashtra condition. The result revealed that application of irrigation at 0.1 IW/CPE ration recorded higher yield attributes yield (1711 kg ha^{-1}), stover yield (3411 kg ha^{-1}), nutrient content and uptake over 0.4, 0.6, 0.8 IW/CPE ratio. Application of FYM @6 t ha^{-1} was found efficient to achieve significant increased grain yield (1701 kg ha^{-1}), stover yield (3303 kg ha^{-1}), Nitrogen, Phosphorus and potassium status in grain and stover and uptake by grain amaranthus over the control.
Keywords: Irrigation, FYM, Vermicomposting

INTRODUCTION

Amaranthus (Amaranthus Paniculatus L.) is a neglected cereal crop belongs to family amaranthacece (dicotyledons, order caryophyllales). Amaranthus grain contains 6 to 10 % oil, which is found mostly within the germ (Betschartet *al*., 1981, Lorenz *et*and Hwang 1985, Garcia et al., 1987). It is predominantly unsaturated oil (76%) and is high linoleic acid, which is necessary for human nutrition. Analyses conducted at the USDA Western Regional Research Center, amaranthus oil was found to have 7% squalene, which is much higher than the amounts found in other common vegetable oils. Squalene, a high priced material is usually extracted from shark livers and used in cosmetics (Lyon and Becker 1987). It is lesser known crop grown either as grain crop or as leaf vegetable in India but little is known about its agro-techniques. Among the various approaches for scheduling of irrigation water for its precise application, climatological approach based on the ratio between irrigation water(IW) and cumulative pan evaporation (CPE) was found to be the most appropriate, judicious use of water and nutrient management play an important role in increasing the yield of amaranthus. Thus, information on water requirement by amaranthus is essential and inevitable. Besides,

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water managements use of organic manures also play important role in improving the soil physical, chemical and biological properties that leads to increase the yield. Hence, the present investigation was undertaken.

MATERIAL AND METHODS

The experiment was carried out during rabi 2011-2012 at Instructional Farm, Collage of Agriculture, Junagadh Agricultural University, Junagadh. The soil was clayey in texture, rich in organic carbon, low in available nitrogen, higher phosphorus and medium in potassium having pH 7.9. The experiment consist of 12 treatment combinations comprised of four levels of irrigation viz., 0.4,0.6,0.8,1.0 IW/CPE ratios and three levels of organic manures viz., No manure, FYM @6 t ha^{-1} and vermicompost @0.5 t ha^{-1} were laid out in split plot design with four replication. Gap filling and thinning operations were carried out 15 days after sowing to facilitate optimum plant population by maintaining intra row spacing of about 15 cm. The crop was fertilized with 60-40-00 kg ha^{-1} in the form of DAP and urea commonly to all the plots and farm yard manure and vermicompost were applied as per treatment. Besides above crop was grown with recommended package of practices. The crop was evaluated in terms of N, P and K concentration and their uptake as well as yield.

RESULT AND DISCUSSION

Effect of irrigation on yield and attributes

Increasing frequency of irrigation from 0.4 to 1.0 IW/CPE significantly increased the yield attributing characters viz., length of spike, length of spikelets and number of spikelets per spike (Table-1). This might be due to the adequate moisture supply resulted into increasing length of spike, length of spikelets and number of spikelets per spike similar response was discussed by Misra*et al*., (1997) and Nehra (2000). The grain and stover yields per plant (Table-1) was significantly influenced due to irrigation treatments. IW/CPE ratio of 1.0 produced 9.5 g grain and 19.0 g stover yield, it was 11.8 and 17.3 percent higher than that recorded under IW/CPE ratio of 0.4. This might be due to higher value of yield attributes resulted in seed size and seed setting achieved well under sufficient moisture supply (IW/CPE ratio 1.0) which help into better translocation of assimilates from source to sink (seed) and consequently bolder seed size was obtained, which finally resulted into higher grain and stover yields per plant. These findings are accordance and stover yields increased with increased in irrigation treatment from 0.4 to 1.0 IW/CPE ratios (table-1). The grain and stover yields obtained under IW/CPE ratio of 1.0 was at par with 0.8 IW/CPE ratios. The percent increase in grain and stover yields under IW/CPE ratio of 1.0 was to the tune of 13.2

and 23.5%, respectively over 0.4 IW/CPE ratio. The higher yield under higher IW/CPE ratios (1.0) was due to higher value of yield attributes. These are the important yield components, which showed significant positive correlation with grain and stover yields (table-1). While the lower grain and stover yields under the lower level of irrigation (0.4 IW/CPE ratio) was due to lower value of growth and yield component resulted into lesser grain and stover yields. Thus, water deficit in plant inhibits photosynthesis, tends to raise plant temperature, consequently increased respiration process that leads to the breakdown of assimilates (Kramer, 1969). Thus, IW/CPE ratio of 1.0 was the satisfactorily good ratio of 1.0 was the satisfactorily good ratio for scheduling irrigation to obtain significantly higher grain and stover yields of amaranth. Similar results were reported by Misra*et al*., (1997) and Nehra (2000).

Effect of organic manures on yield attributes

Significantly increased in yield attributes viz., length of spike, length of spikelets, length of spikelets per spike, grain and stover yields per plant, test weight (Table-1) were recorded with the application of FYM @6 t ha^{-1} over control. The beneficial effect of organic manures on yield attributes could be due to the fact that after proper decomposition and mineralization, the manure supplied available nutrients directly to the plant and also had solubilising effect on fixed forms of nutrient in soil (Sinha, 1981). Addition of FYM in soil having medium status of nutrient might have increased availability of macro and micro nutrients by improving root rhizsophere which ultimately enhanced removal of N, P and K as well as crop yield. Similar results were also reported by prajapati et al., (1997) in pearlmillet. Application of FYM @6 t ha^{-1} produced significantly higher yield and stover yield might be due to higher value of growth and yield attributes. Which ultimately resulted in increase in grain and stover yield. The increase in grain and stover yield with the application of FYM might be due to adequate quantities and balanced proportion of plant nutrients supplied to crop during crop growth and development period. Reported by Thenmozhi and Paulraj (2010).

Effect of irrigation on nutrient content and uptake

The data related to the content and uptake of nitrogen phosphorus and potassium (Table 2 and Table 3) increasing with IW/CPE ratio from 0.4 to 1.0 increased N, P and K content and uptake by grain and stover. Treatment I_4 (1.0 IW/CPE ratio) which received nine irrigations including two common irrigation first immediately after sowing, second 10-12 DAS and remaining seven at 11,21, 32,45, 53,61, and 69 DAS showing higher value of N, P and K content of 2.74, 1.34, 1.14 in grain and 1.12, 0.33 and 0.34 % in stover, accordingly.

Similarly, same treatment recorded significantly higher N, P and K uptake of 46.88, 22.84 19.77 by grain and 38.09, 11.21 and 11.27 by stover kg ha^{-1} respectively followed by (I_3). The probable reason for increase in content and uptake of nutrients under higher IW/CPE ratio may be the more nutrients move along with the stream of moisture when moisture conductivity of soil is high. Further, when moisture content is more, the rate at which nutrient content reach to root surface is high which in turn contributes to high nutrient uptake Tisdal and Nelson (1957).

Effect of organic manures on nutrient content and uptake

Application of FYM @ 6t ha^{-1} significantly increased the nitrogen phosphorus and potassium content and uptake (Table 2 and Table 3) by the crop. Maximum N, P and K content in grain 2.64, 1.32 and 1.11; and 1.00, 0.31 and 0.32 in stover respectively were observed with the application of FYM @6 t ha^{-1}. Corresponding values of N, P and K uptake by grain and stover with application of FYM @6 t ha^{-1} were 44.00, 22.16, 18.00 and 34.92, 10.18, 10.05 kg ha^{-1}, accordingly. The increase in nutrient content and uptake with application of FYM @6 t ha^{-1} might due to increased availability of nutrient to the plants. It was also improving the soil environment, which encouraged proliferous root system, resulting in better absorption of moisture and nutrient and thus resulting in higher biomass production. Singh and Agarwal (2004). The increase in nutrient uptake may be due to an increase in availability of N, P and K contents in the soil, and improved soil structure for higher uptake of nutrient similar result were also observed by Davari *et al*., (2012).

Table 1. Effect of irrigation and organic manures on yield attributes.

Treatments	Length of Spike (cm)	Length of spikelets (cm)	Number of spikelets per spike (g)	Grain yield per plant (g)	Stover yield per plant (g)	Grain yield (kg ha^{-1})	Stover yield (kg ha^{-1})	Test weight (g)
Irrigation								
I_1:0.4IW/CPE ratio	35.5	16.3	47.0	8.5	16.2	1513	2761	0.50
I_2:0.6 IW/CPE ratio	37.9	18.9	49.3	8.9	17.2	1588	3006	0.51
I_3:0.8 IW/CPE ratio	38.8	19.6	50.7	9.3	17.6	1683	3264	0.53
I_4:1.0 IW/CPE ratio	39.4	19.8	51.3	9.5	19.0	1711	3411	0.54
SEm.±	1.40	0.40	0.78	0.10	0.28	10.25	53.10	0.005
C.D. at 5%	NS	1.50	2.51	0.32	0.91	32.51	169.88	0.01
C.V. %	12.9	9.20	5.49	3.84	5.66	8.43	7.86	3.59
Organic manures								
M_0: No manures	36.2	18.3	46.9	8.4	16.5	1506	2775	0.50
M_1: FYM @ 6 t ha^{-1}	39.3	19.0	51.4	9.3	18.1	1701	3303	0.53
M_2:Vermicompost @ 0.5 t ha^{-1}	38.1	18.7	50.8	9.3	17.9	1664	3252	0.52
SEm.±	0.80	0.40	0.45	0.07	0.17	9.67	51.97	0.004
C.D. at 5%	2.40	NS	1.33	0.22	0.49	28.43	151.69	0.01
C.V. %	8.70	8.70	3.69	3.39	3.91	7.80	7.23	3.38

Table 2. N, P and K in grain and stover as influenced by irrigation and organic manures.

Treatments	Nutrient content (%)					
	N		P		K	
Irrigation	Grain	Stover	Grain	Stover	Grain	Stover
I_1:0.4IW/CPE ratio	2.41	0.88	1.28	0.27	0.96	0.25
I_2:0.6 IW/CPE ratio	2.54	0.89	1.31	0.30	1.00	0.27
I_3:0.8 IW/CPE ratio	2.67	1.08	1.32	0.31	1.08	0.32
I_4:1.0 IW/CPE ratio	2.74	1.12	1.34	0.33	1.14	0.34
SEm.±	0.02	0.01	0.01	0.005	0.02	0.008
C.D. at 5%	0.07	0.05	0.04	0.02	0.06	0.02
C.V. %	2.98	6.45	3.31	6.59	5.72	12.92
Organic manures						
M_0: No manures	2.53	0.90	1.31	0.30	1.00	0.27
M_1: FYM @ 6 t ha^{-1}	2.64	1.00	1.32	0.31	1.11	0.32
M_2:Vermicompost @ 0.5 t ha^{-1}	2.63	0.97	1.31	0.30	1.07	0.30
SEm.±	0.01	0.01	0.004	0.002	0.01	0.006
C.D. at 5%	0.05	0.04	0.01	0.008	0.04	0.02
C.V. %	2.88	6.01	1.43	3.54	5.27	9.70

Table 3. N, P and K uptake by grain and stover as influenced by irrigation and Organic manures.

Treatments	Nutrient Uptake (kg ha^{-1})					
	N		P		K	
Irrigation	**Grain**	**Stover**	**Grain**	**Stover**	**Grain**	**Stover**
I_1:0.4IW/CPE ratio	36.20	24.07	19.19	7.03	14.61	6.79
I_2:0.6 IW/CPE ratio	40.18	25.57	20.60	9.79	15.26	8.47
I_3:0.8 IW/CPE ratio	44.18	35.11	22.50	10.26	18.89	10.86
I_4:1.0 IW/CPE ratio	46.88	38.09	22.84	11.21	19.77	11.27
SEm.±	0.76	1.39	0.61	0.25	0.21	0.25
C.D. at 5%	2.44	4.44	1.98	0.81	0.68	0.81
C.V. %	5.56	15.67	5.64	9.16	4.60	9.42
Organic manures						
M_0: No manures	38.56	25.34	19.89	8.66	15.93	8.26
M_1: FYM @ 6 t ha^{-1}	44.00	34.92	22.16	10.18	18.00	10.05
M_2:Vermicompost @ 0.5 t ha^{-1}	43.03	31.86	21.80	9.87	17.47	9.74
SEm.±	0.68	1.05	0.42	0.21	0.19	0.21
C.D. at 5%	2.00	3.06	1.24	0.62	0.57	0.62
C.V. %	5.31	13.69	5.31	9.01	4.30	9.20

Conclusion

It may be concluded that application of irrigation scheduling at 1.0 IW/CPE ratio with combination of FYM @6 t ha^{-1} significantly increased yield attributed and nutrient uptake and content.

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