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Response of Integrated Nutrient Management on Growth, Yield Attributs and Yield of Grain Amaranth (*Amaranthus hypochondriacus* L.) under Middle Gujarat Conditions

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A field experiment was conducted at the College Agronomy Farm, B.A.College of Agriculture, Anand Agricultural University, Anand, Gujarat in *rabi* season of the year 2011-2012 to study the effect of integrated nutrient management in grain amaranths under middle Gujarat conditions. The experiment was laid down in Randomized Block design comprising of ten treatments including 100 % RDFwith four replications. The soil of experimental area was loamy sand with low in available nitrogen (141.42 kg/ha), organic carbon (0.22 %), medium in available phosphorus (44.83 kg/ha) and high in available potash (300 kg/ha) with pH of 7.8. The results revealed thatapplication of 50% RDF + Vermicompost @ 2t ha^{-1} mixed with *azetobacter*& PSB recorded higher plant height at harvest, paniclelength and number of panicles plant^{-1}. While, days to 50%flowering was significantly affected by application of 50% RDF + NADEP Compost @ 4t ha^{-1}mixed with *azetobacter*& PSB. Significantly higher lodging percentage was recorded in treatment application of 100% RDF + Vermicompost @ 1t ha^{-1}. Application of 50 % RDF + vermicompost @ 2 t/ha mixed with *azetobacter* and PSB recorded higher grain and straw yields, test weight, Protein content and higher net realization.

Key words: Vermicompost, FYM, PSB, *Azetobacter and*, Amaranth.

Grain amaranth/Rajagira is potent upcoming subsidiary food crop in the future, belong to the family Amaranthaceae. The word "amaranth" comes from the Greek Word "Amarantos" means "the one that do not wither" or "the never fading flower". Amaranth is a quick growing, bushy plant with thick stalks. Being a C_4 plant, it has more efficiency of nitrogen utilization and photosynthesis (Magomedov *et.al.*,1997). Amaranth aptly termed as "poor man's spinach" has enough potential for competing, under and malnutrition prevalent in many parts of the world. Besides a better source of enriched infant food, the unique features of Amaranth *viz* low water and input (25 kg N + 12.5 kg P_2O_5/ha) requirement, tolerance to moisture stress with lesser growing period and wide adaptability have created interest among the farmers for its cultivation in arid and semi-arid regions of Gujarat. Proper nutrient management is very much important for increasing the productivity of the crop. Nitrogen is basic input for the growth of the plant. The increasing cost of fertilizers and its scarce availability lead to incredible rise in the cost of production and there by decrease in profit. In this aspect, the integrated nutrient management is gaining importance.

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MATERIALS AND METHODS

A field experiment was conducted at the College Agronomy Farm, B.A.College of Agriculture, Anand Agricultural University, Anand, Gujarat in *rabi* season of the year 2011-2012to study the effect of integrated nutrient management in grain amaranths under middle Gujarat conditions. Recommended variety Gujarat Amaranthus-2 (GA-2) was utilized for experiment.The sandy loam soil was low in organic carbon, low in available nitrogen, and medium in phosphorus and high in available potassium. There were total ten different treatments viz. (T_1) Recommended dose of fertilizer (RDF) (25:12.5 : 0 kg NPK /ha). (T_2) : 100 % RDF + NADEP compost @ 2t/ha, (T_3) : 75 % RDF + NADEP compost @ 3 t/ha mixed with *Azetobacter* and PSB (1 liter / 10 t compost), (T_4) :50 % RDF + NADEP @ 4 t/ha mixed *Azetobacter* and PSB(T_5) : 100 % RDF + vermicompost @ 1 t/ha, (T_6)75 % RDF + vermicompost @ 1.5 t/ha mixed with *azetobacter* and PSB (1 liter / 10 t vermicompost, (T_7) 50 % RDF + vermicompost @ 2 t/ha mixed with *azetobacter* and PSB, (T_8) 100 % RDF + vermiwash (1:1) foliar spray (3 time at 30 , 45 and 60 DAS), (T_9) 75 % RDF + vermiwash mixed with *Azetobacter* foliar spray (at 30, 45 and 60 DAS 5 ml/liter) and (T_{10}) : Vermicompost @ 2t/ha + *Azetobacter*foliar spray (at 30, 45 and 65 DAS (5 ml/liter) with four replications. Nutrient content of NADEP (N 0.25 %, P_2O_5 0.72 %, K_2O 0.34% and OC 7.42 %) and vermin compost (N 1.98 %, P_2O_5 1.56 %, K_2O 0.83% and OC 31.98 %). All recommended agronomical practices carried out during experiment periods. Sample were be taken by tagged randomly selected tagged plant at initial stage for taking all observations.The value of S.Em.± and C.D. at 5%and co-efficient of variation (C.V. %) was also worked out to evaluate the treatments.

RESULTS AND DISCUSSION

Growth parameters

Data presented in Table-1 indicated that treatment T_4(50 % RDF + NADEP @ 4 t/ha mixed *Azetobacter* and PSB) recorded significantly higher plant height at 45 DAS and days to 50 % flowering. While, plant height at 60 DAS and lodging percent was higher in treatment T_5 (100 % RDF + vermicompost @ 1 t/ha). Application of 50 % RDF + vermicompost @ 2 t/ha mixed with *azetobacter* and PSB (T_7) recorded higher plant height at harvest. Increasing plant height at various stages might be due to integration of various nutrient sources as against RDF alone may be due to the constant nutrient supply through the mineralization from the organic sources at later stage of crop growth as compared with the initial stage. The higher day to 50 % flowering was attributed to 50 % RDF+ NADEP compost @ 4 t/ha mixed with *Azetobacter* and PSB (T_4), this might be due to the high availability of nitrogen, which makes the plant to continue in the vegetative phase and thus taking more time to attain 50 % flowering and higher lodging might be vegetative growth than can lead to lodging at later stages.

Yield attributes and yield

Data presented in Table-2 indicated that grain (2785 kg/ha) and straw yields (6275 kg/ha) of grain amaranth was higherin treatment application of 50 % RDF + vermicompost @ 2 t/ha mixed with *azetobacter* and PSB (T_7). Integrated nutrient management practices have resulted in higher yield of grain amaranth by attributing higher plant growth and development, which helped in augmenting the grain and Stover yields. Prolong availability of soil moisture due to organic manure increased uptake of nutrients, release of phyto-hormones and organic acids which provides foods for beneficial bacteria all might have contributed to the yield (Jaybal *et al*., 1998).

Perusal of data presented in Table-1 indicated that yield attributing character significantly influenced by various integrated nutrient management treatment. Application of 50 % RDF + vermicompost @ 2 t/ha mixed with *azetobacter* and PSB recorded higher panicle length (78.09 cm), number of panicle/plant (6.69) and test weight (0.89 gm). The significantly increasing test weight is mainly due to the increasing in photosynthesis and better transfer of assimilates.

Date presented in Table-2 indicated that application of 50 % RDF + vermicompost @ 2 t/ha mixed with *azetobacter* and PSB (T_7) recorded significantly the highest protein content (0.89 %) over rest of treatment. Increasing protein content might be due to higher vegetative growth and yield attributing characters, which might have helped to increase the uptake of nitrogen and thus increased the protein content of grain amaranth significantly.

Table 1. Effect of different treatments on growth and yield attributes of grain amaranth

Treatment	Plant height (cm)				Days to 50 % flowering	Lodging	Panicle Length (cm)	No. of panicle /plant	Test weight (1000 seed wt. gm)
	30 DAS	45 DAS	60 DAS	At harvest					
T_1	70.80	82.45	128.45	147.31	41.00	11.29	76.13	4.42	0.81
T_2	82.60	97.03	134.60	147.46	44.25	12.35	75.50	3.66	0.83
T_3	87.68	100.59	141.82	149.78	45.00	10.66	77.10	4.22	0.79
T_4	92.74	108.39	138.55	148.86	46.50	11.73	75.19	4.88	0.80
T_5	90.42	103.09	149.51	151.50	42.88	21.33	75.78	6.44	0.76
T_6	82.65	93.56	128.88	137.29	43.25	11.09	74.60	4.83	0.72
T_7	91.20	102.31	140.78	156.40	43.75	15.02	78.09	6.69	0.89
T_8	86.21	99.65	137.42	149.15	41.13	15.95	71.72	4.28	0.84
T_9	86.27	99.40	144.10	150.80	40.25	12.21	74.08	4.00	0.79
T_{10}	82.17	91.91	134.80	145.89	42.50	11.01	66.48	3.56	0.82
S.Em.±	4.40	4.75	3.94	3.17	0.88	0.73	1.97	0.30	0.02
C.D.(P=0.05)	NS	13.78	11.43	9.21	2.57	2.13	5.72	0.88	0.07
C.V.(%)	10.33	9.71	5.71	4.28	4.11	11.08	5.30	12.92	5.88

Table 2. Effect of different treatments on yield , quality, post harvest nutrient status and economic of grain amaranth

Treatment	Grain Yield (Kg/ha)	Straw yield (Kg/ha)	Protein content (%)	Post harvest soil nutrient status			Net realization (Rs./ha)	BCR
				N	P_2O_5	$K_{2-}O$		
T_1	2508	6025	15.35	118.75	41.98	297.70	88975	6.20
T_2	2258	5627	16.71	122.62	52.45	328.20	74376	3.96
T_3	2705	5654	16.47	116.23	73.10	293.67	89367	4.13
T_4	2458	6157	16.39	101.97	76.36	302.11	77698	3.38
T_5	2588	5226	16.68	124.11	80.95	313.88	87375	4.66
T_6	2506	5191	14.46	106.04	63.78	295.20	81225	3.76
T_7	2785	6275	18.03	126.11	75.73	307.24	90903	3.85
T_8	2445	5388	13.99	117.87	53.56	326.79	77028	3.28
T_9	2586	5818	15.21	101.51	60.18	271.68	81999	3.36
T_{10}	2044	4607	14.12	109.16	71.73	412.55	59407	2.41
S.Em.±	101.03	279.2	0.27	4.83	1.56	16.69	-	-
C.D.(P=0.05)	294.1	810.4	0.79	14.01	4.56	48.44	-	-
C.V.(%)	8.15	9.98	3.46	8.44	4.81	10.60	-	-

Soil fertility status

Perusal of data presented in Table-2 indicated that application of 50 % RDF + vermicompost @ 2 t/ha mixed with *azetobacter* and PSB (T_7) recorded higher available nitrogen in soil. This could be attributed to the high content of nitrogen in vermicompost which is applied in high quantity as well as mineralization of organic matter and nutrient found in available form. Available P_2O_5 was higher in treatment T_5 i.e 100 % RDF + vermicompost @ 1 t/ha). While,application of 100 % RDF + NADEP compost @ 2t/ha (T_2) recorded significantly higher available K_2O after harvest of crop.

Economic

The effect of different treatments on economics indicated that, the maximum net realization to the tune of Rs. 90903/ha was obtained in treatment application of 50 % RDF + vermicompost @ 2 t/ha mixed with *azetobacter* and PSB (T_7) among all other treatments. The increase in profit was mainly due to higher economic yield. Minimum net realization (59407) was noted in treatment application Vermicompost @ 2t/ha + *Azetobacter*foliar spray (at 30, 45 and 65 DAS (5 ml/liter) (T_{10}) with BCR 2.41.

CONCLUSION

From the ongoing discussion it is conclude that , the integrated approach adopted in raising grain amaranth was found best, not only in term of income but also with respect to yield, quality and soil health. Through raising the crop with RDF alone has economic benefit, but also considering the sustainability in crop production, the integrated approach can be a better option for the successful raising grain amaranth. Out of different treatments application of 50 % RDF along with vermicompost @ 2 t/ha mixed with *Azetobacter* and PSB was found superior.

REFERENCES

1. Bhattacharya, P. and Kumar, R., Liquid biofertilizer- current knowledge and further prospect. Procceedings of National Seminar on'Development and use of bio-fertilizers, bio-pesticides and organic manures', Bidan Chandra Krishi Viswavidyalaya, *Mohanpur.* 2002; 10-21.
2. Chaudhari, P. P., Patel, P.T. and Desai, L. J., Effect ofnitrogen management on yield, water-use, and nutrient uptake of grain amaranth (A. hypochondriacus L.) under moisture stress: *Indian Journal of Agronomy* 2009; **54**(1):69-73.
3. Hedge, S. V., Liquid biofertilizers in IndianAgriculture. *Biofertilizers Newsletter* 2002; **10**: 17-25.
4. Jaybal, A., Palanippan, S. P. and Chelliah, S., Evaluationof press-mud based bio-compost in maize. *Madras Agricultural Journal,* 1998; **85**(2): 148-149.
5. Magomedov, T. M., Shumilova, A. A. and Fedoseenko, A. A., Dependence of the efficiency of nitrate nitrogen utilization on the photosynthetic activity in $C_3$and C_4plants. *Docklady-Biochemistry* 1997; **355**: 1-6, 89-90.
6. Narain, P., Balanced fertilizer use in dryland agriculture:Issue and concerns. In fifty years of Dry-land AgricultureResearch in India, CRIDA, Hyderabad: 1999; 345-355.
7. Parmar, J. K. and Patel, J. J., Effect of nitrogen management on the growth and yield of grain amaranthus (Amaranthus hypochondriacus L.) grown on loamy sand soils. *Asian Journal of Soil Science*. 2009; **4**(1): 106-109.
8. Thenmozhi, S. and Paulraj, C., Effect of composts on yield of amaranthus and soil fertility. *Agriculture Science Digest*, 2010; **30**(2): 90-93.