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Research Article

PERFORMANCE OF ALL INDIA CO-ORDINATED VEGETABLE IMPROVEMENT PROJECT (AICVIP) TRIAL (AVT-II) ON GROWTH, YIELD AND QUALITY OF AMARANTHUS

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Abstract: A field experiment was carried out to study the performance of All India Co-Ordinated Vegetable Improvement Project (AICVIP) varietal trial (AVT-II) on growth, yield and quality of Amaranthus were conducted from 2012 to 2013 at the Department of Vegetable Crops, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore. The experiment was laid out in Randomized Block Design (RBD) with three replications, which included Ten Amaranthus AVT II genotypes *viz*.2012/AMVAR- 1, 2012/AMVAR- 2, 2012/AMVAR- 3, 2012/AMVAR- 4, 2012/AMVAR- 5, 2012/AMVAR- 6, 2012/AMVAR-7, Arka Suguna (C) and Arun (C) and CO5 (LC). The Amaranthus genotypes were sown with care in the field during the year 2012 to 2013 at the spacing of 60 x 10 cm with the plot size of 3.0 x 2.5m. Significant differences were observed among the genotypes for growth and yield parameters. Among the entries tested (AVT-II), the highest leaf yield (152.1 q/ha) was recorded in 2012/AMVAR-1 followed by 2012/AMVAR-2 (140.4 q/ha).

Keywords: *AICRP-VC- Amaranthus Entries (AVT-II), growth, Yield*

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Introduction

Amaranthus cruentus L. commonly known as Amaranth belongs to the family Amaranthaceae. It is a leafy vegetable commonly cultivated in Nigeria and other West African countries [1].It has a growing period of 5 to 6 weeks thus making it an advantage for the rural and peri-urban farmers in Nigeria to keep cultivating it two or more times on the same piece of land in a year [2] .Till now, the bulk of vegetables consumed in Nigeria are supplied by subsistence farmers. Apart from *A. cruentus* uses as a vegetable, its grains can also be cooked as a cereal, popped like popcorn, toasted or even ground into flour for baking [3]. Vegetable supply to areas of high demand has remained low and seasonal as most of the subsistence farmers continue to rely on natural rainfall. The current high demand for vegetables in the cities and towns has stimulated the growth of market gardening along perennial rivers and streams in major towns and cities in Nigeria. Some farmers rely on irrigation water from streams, wells and boreholes to cultivate vegetables all year round. Organic production of vegetables has become good source of employment for young school leavers and are also preferred in quality to conventional ones [4]. It is widely cultivated in various regions of the world as well as in Nigeria as food and leafy vegetable[5] .The crop belongs to the family *Amaranthaceace and* genus *Amaranthus*. There is no clear dividing line between a vegetable type and grain type. The leaves of vegetable amaranth are nutritionally significant source of minerals included vitamin A, vitamin B6, vitamin C and vitamin K. The grain is grind into flour for use in bread, noodles, pancake, cereals, granola, cookies and other flour based product [6]. Several studies have shown that, like Oats, amaranth is beneficial for people with hypertension and cardiovascular disease [7]. Regular consumption reduces blood pressure and cholesterol level which improved antioxidant stages and some more immune parameters [8 &9]. It is also a potential source of forage (9.9 – 12.7 t ha^{-1}) dry matter as well as 74 – 148 t ha^{-1} of silage (80 % moisture) [10]. *Amaranthus cruentus* L. is a tall annual herb topped with cluster of dark pink flower and can grow up to 2 m in height [11]. The main nutrients present in fertilizers are nitrogen (N), phosphorus (P) and potassium (K) (macro nutrients) and other nutrients (micro nutrients) are added in smaller amount. Nitrogen fertilizers promote vegetative growth and impart the characteristics of deep green colour essentially for photosynthesis [12]. The Optimum N amount reported for maximum *amaranthus* growth ranges from 45 kg to 100 kg N ha^{-1}.

Materials and Methods

The experimental material *i.e*. seed packets of all the Amaranthus varietal entries (AVT-II) received from the Project Coordinator, AICRP (Vegetable Crops), IIVR, Varanasi, Uttar Pradesh (India), were sown during the year 2012 to 2013. All the genotypes were sown in the field in randomized block design with three replicates, at the spacing of 60 x 10 cm with the plot size of 3.0 x 2.5m .The experimental plot was irrigated at fortnightly interval with basin irrigations and was kept weed free. The crop was raised as per the TNAU recommended packaging practices of Apply *Azospirillum* 2 kg and Phosphobacteria 2 kg/ha, Basal dose: FYM 30 t / ha, NPK 30:80:80 kg / ha. Top dressing: 30 kg N / ha in equal splits on 30, 60 and 90 days after planting. For recording field observations on vegetative, yield and other yield attributing parameters, five randomly chosen plants were tagged from each genotype in each replication were used. Green marketable yield data were recorded picking wise and calculated on hector basis. Analysis of variance in respect of the various characters was done. The results of the Amaranthus varietal entries (AVT-II) were presented in the Table 1.

Result and Discussion

The analysis of variance was conducted to test significance different among genotype studied. The performance of various genotypes of Amaranthus under Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu condition is presented in Table 1. The results revealed that differences due to various genotypes were highly significant for all the characters under study indicating considerable amount of variability among the genotypes tested, the highest leaf yield (152.1 q/ha) was recorded in 2012/AMVAR-1 followed by 2012/AMVAR-2 (140.4 q/ha).

Table-1 *Performance of growth, yield and quality of Amaranthus (AVT-II)*

Name of the entry	Days to first harvest	Marketable yield (kg/plot)	Unmarketable yield (kg/plot)	Yield (q/ha)	Plant weight (g)	Leaf weight (g)
2012/AMVAR-1	25.0	11.7	0.390	152.1	12.3	4.35
2012/AMVAR-2	27.0	10.8	0.350	140.4	11.5	3.95
2012/AMVAR-3	29.0	9.9	0.220	128.7	10.1	3.55
2012/AMVAR-4	30.0	7.9	0.120	102.7	7.6	1.85
2012/AMVAR-5	26.0	8.8	0.150	114.4	12.9	7.55
2012/AMVAR-6	29.0	9.2	0.180	119.6	8.6	4.85
2012/AMVAR-7	35.0	8.1	0.140	105.3	9.8	6.35
Arka Suguna (C)	30.0	9.6	0.200	124.8	13.6	9.75
ARUN (C)	32.0	9.8	0.230	127.4	8.8	6.75
CO5 (LC)	29.0	10.0	0.260	130.0	8.2	7.75
CD (p=0.05)	1.265	1.021	0.0231	12.951	0.126	0.589
CV%	8.36	9.69	3.89	9.68	7.70	6.96

Name of the entry	Stem weight (g)	Stem girth (cm)	Leaf length (cm)	Leaf breadth (cm)	Crop duration
2012/AMVAR-1	5.17	3.0	9.1	5.1	51.0
2012/AMVAR-2	4.83	2.5	6.5	4.5	53.0
2012/AMVAR-3	4.24	2.5	6.8	5.5	58.0
2012/AMVAR-4	3.19	2.1	4.3	3.6	55.0
2012/AMVAR-5	5.42	3.2	9.0	5.7	57.0
2012/AMVAR-6	3.61	3.3	8.7	5.0	59.0
2012/AMVAR-7	4.12	2.5	8.7	6.0	57.0
Arka Suguna (C)	5.71	3.1	12.2	7.0	54.0
ARUN (C)	3.70	2.9	11.1	6.8	58.0
CO5 (LC)	3.44	3.3	7.6	5.0	56.0
CD (p=0.05)	0.478	0.356	1.24	0.98	7.43
CV%	8.36	5.96	8.61	9.56	7.77

The results revealed that (AVT-II), Days to first harvest was recorded (25days) in 2012/AMVAR-1followed by 2012/AMVAR-5 (26 days) and the highest plant weight (13.6g) was recorded in Arka Suguna (C) which was followed by2012/AMVAR-5 (12.5g) ,The maximum leaf weight was recorded (9.75g) in Arka Suguna (C) which was followed by (7.75g) in CO 5 (LC) , the highest stem weight were recorded (5.71g) in Arka Suguna (C) followed by 2012/AMVAR-5 (5.42g), the maximum stem girth was recorded (3.3 cm) in CO 5 (LC) followed by 2012/AMVAR-5(3.2cm), the maximum leaf length were recorded (12.2cm) in Arka Suguna (C) which was followed by Arun (C) (12.2cm), the maximum leaf breadth was recorded (7.0 cm) in Arka Suguna (C) followed by (6.8cm) in Arun (C), The highest marketable leaf yield was recorded (11.7kg/plot) in 2012/AMVAR-1which was followed by (10.8kg/plot) in 2012/AMVAR-2 ,the highest leaf yield (152.1 q/ha) was recorded in 2012/AMVAR-1 followed by 2012/AMVAR-2 (140.4 q/ha).Whereas the checks Arka Suguna, Arun and CO 5 (LC) were recorded the yield of 124.8, 127.4 and 130.0 q/ha respectively. The growth and yield of amaranth was strongly influenced by soil fertility when an inorganic fertilizer, but not by manure. In common with many plants, nitrogen supply is known to have a considerable effect on the yield of amaranth [7]. It was found that fresh and dry shoot yields and grain yield, were significantly influenced by N rates. Although the highest fresh shoot yield increased up to the maximum rate of 60 kg N ha^{-1}, there was no significant difference between the values obtained at 45 and 60 kg N ha^{-1}, which is similar to our experience with vegetable amaranth. The lack of any yield increase in the manured plots was not unprecedented [9]. It was working with maize (*Zea mays*) and cow pea (*Vigna unguiculata*), found out that use of manure did not result in significant yield gains [13]. The nitrogen content of the leaves is important in two major respects; the reduced (amino) K-N content is nutritionally important as this is largely made up of protein, whereas the oxidized (nitrate) nitrogen content is important because of its toxicity. The increase in foliar K-N or protein with increasing N fertilization under high irradiance conditions is consistent with numerous published reports [14].Though the K-N contents of the control and manured plants were lower than that of the DAP fertilized plants, the decrease was proportionately much less than that of Effect of DAP, manure and time of harvesting on both ascorbic acid and Kjeldahl nitrogen content of vegetable amaranth (*A. hypochondriacus*) yield. A beneficial effect of the manure treatment, despite its low yield, was the generally higher K-N content of the manured plants compared to the controls. An interesting consequence of these relationships for the consumer is that, even if amaranth is grown on fallow land, the K-N content of its foliage is still appreciable compared to that from fertilised land, so arguably the K-N content of fresh amaranth might always be expected to lie within a limited range of values. The K-N content of leaves of the related *Amaranthus palmeri* grown under natural conditions was observed to decrease from about 4.5 % to just over 2.0% during a prolonged drought stress that ultimately stopped photosynthesis [15]. If *A. hypochondriacus* were to behave in a similar way, it would suggest that even drought-stressed plants would retain significant, if diminished, nutritional value. A consequence of nitrogenous fertilization is that, if supplied in excess some of the N taken up, will accumulate as nitrate in the vacuoles instead of being converted to amino- nitrogen [16].This accumulated foliar nitrate poses a health risk and is often subject to regulation. Therefore, the benefits of increased yield and increased protein content of leafy vegetables arising from nitrogenous fertilization need to be balanced against the risk of excessive nitrate contents. A comparison of the K-N content with the nitrate content of the leaves suggests that up to about 35 g kg^{-1} (3.5%) K-N nitrate does not accumulate excessively, and the balance of K-N and nitrate favours K-N. Above 35 g kg^{-1} K-N though further increases of K-N can still occur (they increase to nearly 60 g kg^{-1} K-N), this only occurs with the accumulation of large amounts of nitrate.

Conclusion

From the above study, it could be concluded, among the ten entries were tested (AVT-II), the highest leaf yield (152.1 q/ha) was recorded in 2012/AMVAR-1 followed by 2012/AMVAR-2 (140.4 q/ha).Whereas the checks Arka Suguna, Arun and CO 5 recorded the yield of 124.8, 127.4 and 130.0 q/ha respectively.

Application of research: The seeds of the Amaranthus AVT II entries *viz*.2012/AMVAR- 1, 2012/AMVAR- 2, 2012/AMVAR- 3, 2012/AMVAR- 4, 2012/AMVAR- 5, 2012/AMVAR- 6, 2012/AMVAR-7, Arka Suguna (C) and Arun (C) nd CO5 (LC). All the entries were sown along with local check CO- 5 were chosen for this study. Among the ten entries were tested (AVT-II), the highest leaf yield (152.1 q/ha) was recorded in 2012/AMVAR-1 followed by 2012/AMVAR-2 (140.4 q/ha).Whereas the checks Arka Suguna, Arun and CO 5 recorded the yield of 124.8, 127.4 and 130.0 q/ha respectively.

Research Category: Vegetable Crops Science

Abbreviations:

ICAR- Indian Council of Agricultural Research

AICRP-VC - All India Coordinated Research Project on Vegetable Crops
AVT- Advanced Varietal trial
AMVAR –Amaranthus Variety
NPK- Nitrogen, Phosphorus and Potash
C- Check (Variety)
LC- Local check variety
Vit- Vitamin
DAP- Di Ammonium Phosphate
q /ha- Quintal per Hectare

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Study area / Sample Collection: Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore, 641003, Tamil Nadu

Cultivar / Variety name: *Amaranthus cruentus* L.

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
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References

[1] Olorode O. (1984) Taxonomy of West African Fl. Plants. Longman Group Ltd.,London, UK, 158.
[2] Adewole M. B., Igberaese S. O. (2011) *Obafemi Awolowo University Press, Ile-Ife, Nigeria,* 454-465.
[3] Railey K. (1999) *http://chetday.com/amaranth.html Accessed on March* 13, 2012.
[4] Dipeolu A.O., Phillip B.B., Aiyelaagbe I.O.O.,AkinbodeS.O., Adedokun T.O. (2009) *Asian J. of Food and Agro-Industry, Special Issue*, S57-S65.
[5] Smitha P.A. (2010) *M.Sc. (Agri.) Thesis, Uni. Agric. Sci., Bangalore, Karkanata, India*.
[6] Putnam D.H. (1990) *Agronomic practices for grain amaranth. In: Stallknech G.F. and J.R. Schulz-Schaeffer. (1993). Amaranth Rediscovered Jamic and J. E. Simon (eds.), New crops. Wiley, New York. Pp* 211-218.
[7] Makus D.J. (1986) *Hort.Sci.*21, 687-697.
[8] Olaniyi J.O., Adelasoye K.A. and Jegede C.O. (2008) *World J. of Agrl.Sci.* 4 (4), 506 -513.
[9] Kolawole E. L. and Sarah O. A. (2009) *Not. Bot. Hort. Agrobot Cluj* 37 (1), 195-199.
[10] Putnam D.H., Doll J.D., Oplinger E.S. and Schulte E.M. (1989) *Amaranth. Alternative field crop manual. Nov*., 1989.
[11] Stallknecht G.F. and Schulz-Schaeffer J.R. (1993) *Amaranth rediscovered. In: Janick, J. and J. E. Simon (eds.) new crops Wiley, New York. Pp* 24-218.
[12] Futuless K.N. and Bagale H.W. (2007) *in Mubi, Adamawa State, Nigeria. In: Proceeding of Horticultural Society of Nigeria (HORTSON), held at Adamawa State University, Mubi, Nigeria. 26th – 30th Oct*. 2008.
[13] Adediran J.A., Taiwo L.B., Akande M.O., Sobulo R.A., & Idowu O.J., (2004) *J. Pl. Nutrition* 27, 1163 – 1181.
[14] Evans J.R. & Terashima I. (1988) *Pl. Cell Physiology* 29, 157 –165.
[15] Ehleringer J. (1983) *Oecologia,* 57, 107-2.
[16] Martinoia E., Heck U. & Wienecken A. (1981) *Nature* 289, 292-294.