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EVALUATION OF VEGETABLE AMARANTH UNDER HOT SUMMER GROWING CONDITION

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ABSTRACT: The performance of 13 vegetable amaranth genotypes was assessed under hot and dry summer condition in red and lateritic belt of West Bengal, India. Significant differences among the genotypes were noticed for various growth and yield attributing traits at three sampling dates (17, 24 and 31 days after sowing). North Dinajpur Collection-4 was recorded as the highest yielder (178.4 q/ha). Bankura Collection-2, Pusa Lal Choulai, Kendrapara Collection-6 and Arka Suguna were relatively low producer, but had high leaf : stem ratio, a desirable trait for any leafy vegetable.

Keywords : *Vegetable amaranth, genotypes, summer condition, yield attributing traits.*

Amaranth is among the few double duty plants that can supply grains of high nutritional quality as well as tasty leafy vegetables. *Amaranthus* are common in India and mostly grown during summer and rainy season for their tender and succulent leaves. Vegetative parts of the plants are high in calcium, potassium, iron, ascorbic acid and dietary fibre, indicating a high food potential (Hill and Rawate, 3). Vegetable amaranth is grown almost round the year in the lateritic belt of West Bengal. However, it often performed poorly in the summer months. Existence of wide variability in various traits was documented in amaranth (Arivazhagan and Kader, 1). Thus, it offers a considerable scope to identify suitable type for any particular region and time. In view of the above points the present research programme was formulated to identify superior genotype(s) suitable for growing in the hot and dry summer condition in red and lateritic belt of West Bengal.

MATERIALS AND METHODS

The present investigation was carried out during summer season of 2006 at Horticulture Farm of Institute of Agriculture, Visva-Bharati, Sriniketan that represents sub-humid, sub-tropical and lateritic belt of West Bengal, India. The experimental material consisted of thirteen vegetable amaranth genotypes (four improved types and 9 land races). The soil of the experimental site was loamy-sand having 6.79 pH, 0.64 % organic carbon, 247.7 kg/ha available nitrogen, 29.8 kg/ha available phosphorus and 280.5 kg/ha available potassium content. The seeds were sown during full summer condition on April 25, 2007 at spacing of 25 cm between rows followed by thinning to 5 cm between plants after two weeks. The net plot size was 2x1 m^2. Randomized Block Design with three replications was adopted for this study. Data was recorded on 10 randomly sampled plants from each replication in three occasions at17, 24 and 31 days after sowing (DAS) for plant height, stem diameter, leaf number, leaf length, leaf width and average weight per plant. Leaf : stem ratio (fresh and dry) were obtained by dividing the leaf weight (fresh and dry) by stem weight (fresh and dry) and recorded in a ratio at final harvest. Data on yield per plot was recorded as whole plot basis during final harvest that was later on converted into estimated yield per ha. The data were subjected to analysis of variation

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(ANOVA) to test significance of different traits across genotypes. Critical differences (CD) were also worked out to find significant differences among means of traits.

RESULTS AND DISCUSSION

Data pertaining to different growth and yield attributes (Table 1) revealed significant differences among the entries for all the studied traits in three sampling dates. The mean values indicated that all the traits increased considerably as the crop advanced from 17 to 31 days. Among the genotypes, Bankura Collection-1 at 17 DAS and Pusa Kirti at 24 and 31 DAS recorded the maximum plant height. Similarly, Bardhaman Collection 1 and Bolpur Collection 2 at 17 DAS, Pusa Kirti at 17 and 24 DAS and Bolpur Collection 2 at 31 DAS recorded the maximum stem diameter. Plant height and stem diameter are the important contributing component characters for the enhancement of foliage yield (Shukla *et al*. 8). Significant differences were also reported for these two traits by (Lohithaswa *et al.* (6) and Hossain and Rahman (4).

Bolpur Collection-2 produced highest number of leaves in all three sampling dates among the entries, however at the same time it also produced the lowest leaf length and width at final harvest. Bardhaman Collection 1 registered maximum leaf length and leaf width on all sampling dates. Significant differences registered for leaf number per plant, leaf length and leaf width in grain amaranth are in agreement with Vaidya and Jain (9). Highest plant weight was registered for North Dinajpur Collection-4 in all three sampling dates confirming to the reports of Rani and Veeraragavathatham (7). A wide range of variation was observed for green yield per hectare (36.1 to 178.4 q). Variation among amaranth genotypes has also been documented for green yield by Varalakshmi and Pratap Reddy (10), Vaidya and Jain (9) and Rani and Veeraragavathatham (7). The mean value for yield per hectare was 76.4 q. The genotype, North Dinajpur Collection 4 was registered as the top performer for foliage yield. It produced 13.9% more greens than Bardhaman Collection 1, the second best performer for yield. The best yielder, North Dinajpur Collection-4 had recorded highest weight per plant. It was also a good performer for stem diameter, leaf number per plant, leaf length and width, and leaf and stem weight. It seems that the medium plant height, more number of leaves, broader leaf size and higher stem weight contributes towards higher yield. Green yield was found positively and significantly correlated with leaves per plant, leaf length, leaf breadth and weight of leaves and stems (Kader and Subramanian, 5).

The entire plant, except root portion is generally consumed in vegetable amaranth. The edible part may be partitioned into leaf and stem components, which helps to understand the relative contribution of different plant parts (*i.e.* leaf and stem) towards yield. Leaf : stem ratio is also a good indicator of leafiness of a genotype. The data on leaf and stem weight and ratios (fresh and dry) at final harvest (Table 2) revealed significant variations were observed for these studied traits. High variations were reported for leaf and stem fresh weight supporting to findings of (Campbell and Abbott (2) and Rani and Veeraragavathatham (7). Bardhaman Collection 1 and North Dinajpur Collection 4 registered maximum leaf weight (fresh and dry). However, highest stem fresh and dry weights were noted in Bolpur Collection-2. Highest stem diameter of Bolpur Collection-2 might contribute towards more stem weight. Bankura Collection-2, Pusa Lal Choulai, Kendrapara Collection-6 and Arka Suguna were relatively low producer, but had high leaf-stem ratio. High leaf and stem ratio indicated that the leaf portion contributed to the yield more than the stem portion. Similar views were expressed by Hossain and Rahman (4), and Varalakshmi and Pratap Reddy (10).

Table 1: Growth, yield and yield attributes of vegetable amaranth.

Genotypes	Plant height (cm)			Stem diameter (mm)			Leaf number/plant			Leaf length (cm)			Leaf width (cm)			Weight per plant (g)			Green yield per ha (q)
	17 DAS	24 DAS	31 DAS	17 DAS	24 DAS	31 DAS	17 DAS	24 DAS	31 DAS	17 DAS	24 DAS	31 DAS	17 DAS	24 DAS	31 DAS	17 DAS	24 DAS	31 DAS	
Bankura Collection 1	6.8	7.1	9.0	1.6	2.5	4.9	4.9	6.3	9.3	1.8	2.1	2.8	1.5	1.7	2.2	0.5	0.9	2.5	36.1
Bankura Collection 2	3.2	4.7	9.0	1.8	2.7	4.5	4.3	6.4	8.6	1.9	3.9	6.1	1.8	3.8	5.5	0.3	2.1	7.5	71.0
Bankura Collection 4-1	4.3	10.2	20.6	2.1	3.2	7.3	3.9	7.0	20.7	1.6	4.3	8.0	1.4	4.0	5.7	0.2	2.6	17.9	129.8
Bankura Collection 10-2	4.7	5.0	20.2	1.7	2.8	6.8	3.8	8.1	13.3	2.0	3.2	8.3	1.6	2.7	5.8	0.3	1.2	14.9	100.2
Bardhaman Collection 1	6.3	7.4	13.9	2.3	3.6	7.1	4.6	6.3	14.9	2.8	5.2	10.8	2.8	4.6	8.9	0.7	3.5	21.9	156.6
Bolpur Collection 2	5.9	10.7	16.4	2.3	3.5	9.6	5.5	12.2	32.0	1.9	2.7	2.7	1.7	1.8	1.9	0.4	2.4	17.7	123.9
Bolpur Collection 2-6	6.7	10.4	9.9	2.1	3.5	3.8	4.4	6.9	7.0	1.7	3.0	5.0	1.3	2.2	3.9	0.3	2.0	3.3	40.9
Kendrapara Collection 6	3.8	6.4	8.8	1.2	2.9	4.5	4.0	7.4	8.5	2.1	4.0	6.7	2.1	3.5	5.8	0.4	2.4	6.8	70.8
N. Dinajpur Collection 4	3.4	4.9	13.0	1.2	2.7	7.9	3.8	6.5	22.3	1.5	3.6	9.9	1.5	3.4	7.8	0.8	4.8	25.7	178.4
Arka Suguna	3.7	4.3	8.8	0.9	1.9	4.4	4.0	6.3	9.2	2.2	4.1	6.8	2.2	3.9	6.2	0.4	1.8	6.2	69.5
Japani Jabakusum	4.1	6.0	11.8	1.1	2.5	4.0	3.9	7.1	7.8	1.8	3.6	5.9	1.7	2.9	4.8	0.3	1.2	5.0	59.7
Pusa Kirti	6.3	14.8	22.2	2.3	4.0	6.6	4.9	5.8	12.1	1.9	5.1	8.4	1.7	3.7	5.7	0.4	4.4	12.7	98.5
Pusa Lal Chaulai	4.1	5.2	7.3	1.0	1.9	2.9	3.5	7.0	7.3	1.4	2.2	3.7	1.3	1.8	3.0	0.2	0.5	2.7	38.3
Grand mean	4.9	7.9	13.1	1.9	3.1	5.7	4.3	7.6	13.3	1.9	3.5	6.5	1.7	3.0	5.2	0.4	2.3	11.1	76.4
C.V.%	7.4	10.5	12.9	17.2	14.3	12.0	9.7	12.3	10.9	8.4	12.0	16.7	7.8	13.6	14.9	15.3	19.8	12.7	15.8
C.D.(P=0.05)	0.6	1.3	2.9	0.6	0.7	1.2	0.7	1.5	2.5	0.3	0.7	1.8	0.2	0.7	1.3	0.1	0.7	2.4	10.3

Table 2: Leaf and stem weight and ratio of vegetable amaranth (fresh and dry).

Genotypes	Leaf fresh weight (g)	Stem fresh weight (g)	Leaf dry weight (g)	Stem dry weight (g)	Leaf : stem ratio (fresh)	Leaf : stem ratio (dry)
Bankura Collection 1	0.100	1.547	0.010	0.167	0.06	0.06
Bankura Collection 2	0.563	1.443	0.093	0.207	0.39	0.45
Bankura Collection 4-1	0.533	7.770	0.143	1.023	0.07	0.14
Bankura Collection 10-2	0.450	6.067	0.113	0.593	0.07	0.19
Bardhaman Collection 1	1.020	5.143	0.153	0.577	0.20	0.27
Bolpur Collection 2	0.130	9.630	0.019	1.327	0.01	0.01
Bolpur Collection 2-6	0.287	0.977	0.040	0.110	0.29	0.36
Kendrapara Collection 6	0.533	1.497	0.113	0.233	0.36	0.49
N. Dinajpur Collection 4	0.967	5.117	0.150	0.587	0.19	0.26
Arka Suguna	0.537	1.483	0.073	0.177	0.36	0.42
Japani Jabakusum	0.400	1.390	0.053	0.150	0.29	0.36
Pusa Kirti	0.520	6.583	0.123	0.627	0.08	0.20
Pusa Lal Chaulai	0.190	0.503	0.032	0.043	0.38	0.74
Grand mean	0.48	3.78	0.09	0.45	0.21	0.31
C.V.%	18.7	18.5	27.6	29.1	29.8	27.8
C.D.(P=0.05)	0.151	1.178	0.040	0.219	0.11	0.15

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