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Evaluation of amaranthus hybrids

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ABSTRACT

Six genotypes of Amaranthus were crossed in a diallel fashion and the hybrids were evaluated at 35 days after sowing. The parent P_4 and P_6 indicated their superiority for yield and many yield components based on their mean performances. The results indicated that the parents involved in the present study differed in their genetic architecture apart from difference in their pedigree, geographical origin and morphological difference. This facilitates an appropriate choice of parents based on the need for improvement of specific traits. P_2 x P_1 appears to be promising for higher yield. Other hybrids P_2 x P_6, P_2 x P_5, P_6 x P_1 and P_2 x P_4 appeared promising for higher yield of greens based on *per se* performance. For improvement of other component characters the hybrids *viz.*, P_1x P_3, P_1 x P_5, P_2 x P_5, P_3 x P_5, P_4 x P_2 and P_5 x P_6 were found promising based on *per se* performance. The hybrid P_2 x P_1 was outstanding for yield of greens and weight of leaves. The hybrids P_4 x P_6 was found to be superior for number of leaves per plant and days for 50 per cent flowering. The hybrid P_2 x P_6 was found to be good for weight of leaves and weight of stem. The crosses can be best utilized for further crop improvement programmes

Key words : Amaranthus, Evaluation, Parents, Hybrids, Yield.

Green leafy vegetables occupy an important place among the food crops as these provide adequate amounts of many vitamins and minerals for humans. They are the rich source of carotene, ascorbic acid, riboflavin, folic acid and minerals like calcium, iron and phosphorous. Among the leafy vegetables, Amaranth (*Amaranthus tricolor*) is an important leafy vegetable grown throughout India. The nutritional value of this crop is excellent, because of its high content of dry matter, carotene, iron, calcium, vitamin C and protein. So evaluation of parents and hybrids is essential to identify the superior parents and hybrids which can be used for further breeding programme. The mean performance is considered as the prime criterion in evaluating the parents by several breeders. Selection of parents for improvement of yield is a crucial step in breeding programmes. Parents with good *per se* performance will yield better hybrids in most accessories. In the choice of parents, high mean value is the main criterion among the breeders for a long time, the *per se* performance of the parents will help in enabling the selection of promising parents.

Similarly the promising hybrids with best performances can also be evaluated based on *per se* performance.

MATERIALS AND METHODS

The experiment were carried out at College Orchard, Tamil Nadu Agricultural University, Coimbatore. The experimental material included six genotypes of vegetable amaranthus which were used as parents, and were designated as P_1, P_2, P_3, P_4, P_5 and P_6. There were raised in a randomized block design with three replications and crossed in a full diallel design. Crosses were made in all possible combinations inclusive of reciprocals and selfs for production of F1's.

The recommended cultural practices as applicable to a leafy vegetable crop (Annon, 1974) were applied. Observations were recorded 35 days after sowing. A total of five plants were evaluated for each cross and parents for recording quantitative characters. Observations were recorded on plant height at maturity, days for 50% flowering, weight of leaves, weight of stem, number of leaves, Leaf area, 1000 seed weight and yield of greens. Evaluation of parents and hybrids were done based on the *per se* performance.

RESULTS AND DISCUSSION

A good association between the performance of the parents leads to the conclusion that choosing of parents for crop improvement programme may be based on their own performance. The evaluation of parents and hybrids was accomplished based on their *per se* performance also. The mean performance of the parents and hybrids in amaranthus are presented in Table 1.

In case of yield of greens, among the parents, the yield of greens ranged from 27.44 in P_3 to 76.65 in P_6. The parent P_6 was outstanding in mean performance for yield of greens (76.65 g) followed by P_2 (70.89g) and P_1 (67.81g). The yield of greens varied from 32.19g in P_5 x P_4 to 96.57g in P_2 x P_1. The yield of greens was also more in the hybrids P_2 x P_6 (92.97g), P_2 x P_5 (91.34g),

Table 1 : Mean performance of the parents and hybrids in Amaranthus

Parents	Yield of greens (g)	No. of leaves (No.)	Weight of leaves (g)	Weight of stem (g)	Leaf area sq.cm.	Days to 50% flowering	1000 seed Weight (g)	Plant height at Maturity (cm)
P_1	67.81	14.50	52.57	16.91	25.70	82.78	817.0	108.52
P_2	70.89	18.40	62.16	38.73	22.09	87.61	949.7	189.26
P_3	27.44	16.60	18.75	8.69	42.77	91.42	909.0	74.43
P_4	31.64	17.80	23.68	7.97	24.72	87.67	980.3	81.50
P_5	50.25	22.70	42.65	27.60	28.04	86.51	940.2	42.42
P_6	76.65	23.80	42.65	23.42	36.30	89.22	875.0	108.33
P_1 x P_2	33.54	22.70	27.48	6.06	26.31	88.52	930.5	109.59
P_1 x P_3	65.37	28.60	42.35	33.03	29.44	90.72	945.8	107.23
P_1 x P_4	64.28	26.60	48.37	35.99	28.41	89.52	958.8	108.51
P_1 x P_5	67.47	26.80	39.40	38.07	25.66	90.47	910.3	110.52
P_1 x P_6	82.68	30.40	58.45	32.43	28.49	89.28	885.7	112.47
P_2 x P_1	96.57	20.50	59.34	37.18	22.09	90.48	951.50	152.73
P_2 x P_3	63.64	22.70	41.89	36.75	21.32	89.42	892.00	153.66
P_2 x P_4	84.31	18.60	52.45	30.60	23.41	87.48	953.60	154.55
P_2 x P_5	91.34	16.60	53.44	37.90	21.62	88.49	958.5	151.40
P_2 x P_6	92.97	23.2	55.40	37.56	23.99	88.27	940.0	152.65
P_3 x P_1	73.60	26.10	35.44	38.17	42.82	95.50	951.7	59.50
P_3 x P_2	55.57	16.60	33.66	21.91	42.77	96.41	896.2	81.86
P_3 x P_4	44.98	14.50	26.18	25.47	41.80	96.59	911.8	54.59
P_3 x P_5	57.43	22.0	29.36	28.09	41.39	95.55	914.0	82.02
P_3 x P_6	55.71	16.60	28.39	27.31	42.39	97.51	913.0	82.68
P_4 x P_1	45.22	30.70	16.43	27.76	25.47	86.60	986.8	91.68
P_4 x P_2	45.55	32.50	18.35	27.20	26.05	86.62	975.0	92.54
P_4 x P_3	50.70	31.4	22.75	27.97	27.63	88.91	983.0	90.45
P_4 x P_5	45.55	46.20	23.60	23.10	24.50	89.43	896.0	91.63
P_4 x P_6	62.62	56.40	36.47	26.16	25.65	87.41	936.0	95.51
P_5 x P_1	75.47	13.50	47.42	28.05	27.47	89.31	919.2	155.80
P_5 x P_2	43.63	16.90	18.42	25.21	27.80	89.51	984.2	154.89
P_5 x P_3	62.54	18.60	38.37	24.14	26.47	90.69	991.2	160.51
P_5 x P_4	32.19	25.2	26.33	15.86	27.26	89.47	996.0	91.68
P_5 x P_6	54.63	26.60	27.51	27.12	27.49	88.34	985.5	135.74
P_6 x P_1	90.62	22.70	51.47	39.15	42.23	87.44	899.8	162.69
P_6 x P_2	60.64	25.50	31.64	28.97	40.27	88.50	885.8	150.67
P_6 x P_3	75.58	23.70	43.40	32.19	40.33	89.52	974.2	170.84
P_6 x P_4	34.64	30.90	23.31	10.80	38.44	88.42	992.5	172.58
P_6 x P_5	32.51	30.50	18.55	14.03	41.29	87.40	989.2	202.58
S.E.±	0.92	0.20	0.160	0.32	0.18	0.47	1.61	0.162
C.D. (P=0.05)	1.83	0.32	0.320	0.63	0.36	0.93	3.21	0.323

P_6 x P_1 (90.62g) and P_2 x P_4 (84.31g). Vijayakumari *et al.* (1999) also reported similar results in cucumber.

The mean value among the parents for number of leaves per plant ranged from 14.5 in P_1 and 23.8 in P_6. In case of number of leaves the range was from 13.50 in P_5 x P_1 to 56.40 in P_4 x P_6. The hybrids P_4 x P_5 (46.20), P_4 x P_2 (32.50), P_4 x P_1 (30.70) and P_6 x P_4 (30.90) were found to be promising. Ram and Singh (1990) and Sundaram (1992) reported similar results in French bean.

The mean value of parents for days to 50 per cent flowering ranged from 82.78 to 91.42 days where P_1 was the earliest and other parents took longer duration. The range among the hybrids was from 87.48 to 97.51 days. The hybrids P_4 x P_1, P_4 x P_2 and P_6 x P_5 also recorded earliness. Ram and Singh (1990), Vijyakumari *et al.*(1999), Aruna (1992), Arora *et al.* (1982) and Suchindra (2002) reported similar results.

Weight of leaves among the parents ranged from 18.75g in P_3 to 62.16g in P_2. Among the hybrids the range was from 16.43g in P_4 x P_1 to 59.34g in P_2 x P_1. The

other promising hybrids are P_1 x P_6 (58.45g), P_2 x P_6 (55.40g), P_2 x P_5 (53.44g) and P_2 x P_4 (52.45g).

The range for the weight of stem varied from 7.97g in P_4 to 38.73g in P_2 among the parents. Among the hybrids, the range was from 6.06 in P_1 x P_2 to 39.15g in P_6 x P_1. Weight of stem was also high in the hybrids P_2 x P_1 (38.17g), P_1 x P_5 (38.07g), P_3 x P_1 (37.00g) and P_2 x P_6 (37.56g).

The parent P_3 had the maximum leaf area 42.77 sq.cm and P_2 had the minimum value (22.09). Among the hybrids, the mean value for leaf area ranged from 21.32 in P_2 x P_3 to 42.82 in P_3 x P_1. Higher leaf area was also recorded by the hybrids P_3 x P_2 (42.77), P_3x P_4 (41.88), P_6xP_1 (42.23) and P_3xP_5 (41.39).

Among the parents for the plant height at maturity, the range was from 42.42 cm in P_5 to 189.26 cm in P_2. The range for this character among the hybrids was from 54.59 cm in P_3 x P_4 to 202.58cm in P_6xP_5. The plant height at maturity was highest in the hybrid P_6 x P_5 (202.58cm). The hybrids P_6 x P_4 (172.58cm), P_6 x P_3 (170.84cm), P_6 x P_1 (162.69cm) and P_5 x P_3 (160.51cm) also recorded higher mean value.

The range for total dry matter was rather very low and it ranged from 12.83 to 25.24 per cent in parents. P_6 recorded the highest. Among the hybrids, the range was better and varied from 11.51 per cent in P_1 x P_6 to 27.20 per cent in P_2 x P_4. In case of total dry matter, the range was from 11.51 in P_1 x P_6 to 27.20 in P_2 x P_4. The hybrids P_2 x P_5, P_2xP, and Px P_4 also registered higher total dry matter.

The 1000 seed weight among the parents ranged from 817.0g to 980.3g. The parent P_4 recorded the highest. Among the hybrids, the range was from 885.7g to 996.0g. The hybrid P_5 x P_4 recorded the highest mean value for 1000 seed weight. The hybrids P_6 x P_4, P_5 x P_3, P_6 x P_5, P_4 x P_1 and P_5 x P_6 also recorded higher 1000 seed weight.

Higher mean expression was observed in parent P_2 for yield of greens (70.89g), This indicated that parent P_2 is a good general combiner. The parent P_6 was outstanding in mean performance for yield of greens(76.65 g). Similar results were expressed by Arun Kumar (2000), Shobha and Aramugam (1991) and Singh and Singh (1989).

The parent P_2 recorded high mean performance for weight of leaves (62.16g), weight of stem (38.73g) and plant height at maturity (189.26 cm). The results are in agreement with the findings of Agarwal *et al.* (2000), Shobha and Arumugam (1991).

The parent P_3 expressed high mean performance for leaf area (42.77 sqcm) alone. The parent P_1 was the earliest in flowering (82.78 days) with outstanding mean performance.The parent P_4 and P_6 indicated their superiority for yield and many yield components based on their mean performances. These parents were as best general combiners.

It is obvious that none of the parents were found promising for all the traits. However, it would be desirable to have multiple crosses involving the parents *i.e.* selection in the seggretating generations to isolate the superior genotype. The selected parental lines having better performance can be crossed in suitable combinations to exploit heterosis. The crosses which showed high specific combining ability can be best utilized for crop improvement.

The results indicated that the parents involved in the present study, differed in their genetic architecture apart from difference in their pedigree, geographical origin and morphological difference. This facilitates an appropriate choice of parents based on the need for improvement of specific traits.

The aim of producing hybrids is to combine the desirable traits of genetically distinct parents. Though high mean performance for yield of greens was recorded by the parents P_6 and P_2, the hybrids involving P_2, P_6 and P_1 also had pronounced heterotic effects. Mohanalakshmi (1995) reported similar results for all these characters in amaranthus. The Parents P_1 and P_5 produce hybrids with early duration whereas the hybrids involving P_2 and P_4 were of medium duration.

P_2 x P_1 appears to be promising for higher yield (96.57 g) based on *per se* performance. Other hybrids P_2 x P_6 (92.97g), P_2x P_5 (91.34 g), P_6 x P_1(90.62 g) and P_2 x P_4 (84.31g) appeared promising for higher yield of greens based on *per se* performance. The results are in consonance with the findings of Aruna (1992), Arora *et al.* (1982) and Sundaram (1992).

For improvement of other component characters the hybrids *viz.*, P_1x P_3, P_1 x P_5, P_2 x P_5, P_3 x P_5, P_4 x P_2 and P_5 x P_6 were found promising based on *per se* performance.

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