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EVALUATION OF DIFFERENT ARROWROOT (*MARANTA ARUNDINACEA* L.) GENOTYPES FOR GROWTH AND YIELD PARAMETERS

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ABSTRACT

Arrowroot is an important starchy vegetable grown in India, which is used both for food and nutraceutical purposes. A study was conducted at RHREC, Dharwad during 2021-2022 with seven genotypes of Arrowroot to assess their performance for growth, yield and quality attributes. Plant height ranged from 103.97 cm (TAr-18-5) to 119.54 cm (TAr-18-10) with mean of 109.45 cm. Number of tillers per plant ranged from 6.21 (TAr-18-5) to 9.15 (TAr-18-10) with a mean of 7.71. Maximum number of leaves was observed in the genotypes TAr-18-10 (56) and minimum in genotypes TAr-18-5 (38.78). The mean of number of rhizomes per plant was 10.93. Maximum number of rhizomes per plant was observed in TAr-18-10 (12.66), whereas minimum was recorded in TAr-18-5 (9.66). Estimated rhizome yield per hectare in arrowroot genotypes was ranged from 20.87 tons (TAr-18-5) to 30.73 tons (TAr-18-10) with an average of 27.14 tons. The dry matter content of arrowroot genotypes ranged from 73.09% (TAr-18-4) to 78.77% (TAr-18-3). The total starch content of arrowroot genotypes ranged from 14.33 percent (TAr-18-3) to 18.39 percent (TAr-18-5). The Carbohydrate content of arrowroot genotypes ranged from 30.44 percent (TAr-18-12) to 32.56 percent (TAr-18-4).The crude protein content of arrowroot genotypes ranged from 3.58% (TAr-18-2) to 4.37% (TAr-18-1).

Key words : *Maranta arundinacea*, Growth, Yield parameters.

Introduction

Arrowroot is an important starchy vegetable grown in India. It belongs to the monocotyledon's tropical ornamental family Marantaceae, having a chromosome number of 2n = 48. Characteristics of this family members are perennial foliage plants with tuberous rhizomes. Generally, plant grows up to 2 m high with erect stem and large leaves on long stalks near base. It has white small flowers arranged in twin clusters at the end of branches. The fruits are capsules in nature, but are unable to set seed (Reddy, 2015). Arrowroot is vegetatively propagated plant, grown from small pieces of rhizome called 'bits' or occasionally suckers. The crop is being cultivated for its edible rhizomes, which has potential utilization as food and medicine. Rhizomes are large, fleshy, cylindrical, obovoid subterranean and covered with fleshy scales.

Arrowroot was originated from South America. It has long been grown in West Indies, particularly St. Vincent, which supplies about 95% of world's commercial products. It spread too many other tropical countries, including India, Sri Lanka, Indonesia, West Indies and Philippines (Odeku, 2013). In India Arrowroot is cultivated in Uttar Pradesh, Orissa, Bihar, West Bengal, Assam, Karnataka and Kerala (Anonymous, 2016). It is the third important group of food crops (tuber crops) after cereals and grain legumes.

Deep, well-drained, slightly acidic loamy soil is best for cultivation. Heavy soil is unsuitable, while light soil cultivation required a degree of shade to get optimum yields. This crop is suitable to intercropping with coconut or areca nut plantations. Arrowroot well grows near the sea at an altitude of 60-90 m and it can be grown up to 900m from the mean sea level.

Hot, humid climate temperature between 20-30° C is suitable for arrowroot cultivation. Evenly distributed sufficient water supply in soil throughout the growing season is a critical factor and about 1500-2000mm annual rainfall is demanded for its good growth. Usually, planting is done in rainy season and this crop is free from serious pests and diseases. It takes 8-10 months from planting to mature for harvest. Successive crops can be cultivated in the same site up to 5-7 years (Reddy, 2015).

It is well-known for traditional medicinal value. Boiled arrowroot helps to cure diarrhea, having a 'soothing and softening effect on mucus membranes' (Kadans, 1985). The starch is an important ingredient for barium meals and tablets preparation since it disintegrates fast). It is also helpful in dyspepsia, dysentery, bronchitis and cough. The pounded rhizomes cure ulcers. It has property as wounds healing from poison arrows, scorpion bites and gangrene. It helps to prevent birth defects, support proper growth and development and improve blood circulation, blood pressure, weight and digestion. Copper and iron in arrowroot are vital for red blood cell components, preventing fatigue, weakness and decreased cognitive function, all symptoms of anemia.

There is a great potential for the commercial production of arrowroot. However, farmers are not coming forward to take up the cultivation due to lack of suitable varieties and standardized production technology. The growers are receptive and look forward to gather information on suitable variety with good package of practices. Though number of varieties has been developed, information regarding their performance is limited. Considering the importance of this crop, there is a prime need to evaluate genotypes to find out the suitable ones (Sivakumar *et al*., 2018).

Materials and Methods

The present investigations on different arrow root genotypes to know their performance for growth, yield and quality attributes was carried out during *Rabi* season in the year 2021-2022, AICRP Tuber Crops at Regional Horticultural Research and Extension Center, Dharwad. North Western Zone of Karnataka state at 15° 16' North latitude and 75° 07' East longitude and an altitude of 678 meters above the mean sea level, which falls in the agro-climatic zone- III of Karnataka. The seven genotypes of arrowroot were used in the study *viz*., TAr 18-1, TAr 18-4, TAr 18-5, TAr 18-10, TAr 18-11, TAr 18-12, TAr 18-14. The experimental field was prepared to a fine tilth by deep ploughing and harrowing. The field was ploughed twice before one month of planting and farm yard manure was incorporated at the rate of @ 10 t ha^{-1} along with RDF at rate of 50, 75 and 25 kg N: K: P per hectare. The experiment was laid out using RCBD with three replications and seven genotypes. All required agronomical practices were followed as per package of practices, to raise a good crop. The crop was harvested depending on rhizomes maturity at 300 days after planting by digging out the rhizomes. The observations were recorded on various growth, yield and quality attributing traits on individual plant performance in population. The data collected from the genotypes on different parameters were subjected to statistical analysis.

Results and Discussion

Growth parameters

Plant height of arrow root differed significantly due to different genotypes during both the years of experimentation and in their pooled data. Among the different genotypes, significantly higher plant height (119.76 cm) was recorded in genotype Tar 18-5, but it was at par Tar 18-1 (119.13 cm) and significantly lower plant height was recorded in genotypes Tar 18-11(106.09 cm) in pooled mean. Similar trend was noticed during the years 2021 and 2022. Among the different genotypes, significantly more number of number of tillers $plant^{-1}$ was noticed in Tar 18-5 genotype during 2021 and 2022 (13.00 and 14.21, respectively), but was on par with Tar 18-1 (12.00 and 13.26, respectively) and Tar 18-10 genotype (11.00 and 12.11, respectively). Pooled data was in accordance with individual years. Significantly lower number of number of tillers $plant^{-1}$ of 9.77 was recorded in the genotype Tar 18-4 in their pooled mean. Similar report was expressed by Pradhan *et al*. (2011), Rangare and Rangare (2013), Sharavati *et al*. (2018) in sweet potato and Shintu *et al.* (2016) in arrowroot. Similar finding was published by Ntawuruhunga *et al.* (2010), Boakye *et al.* (2013) for number of rhizomes per plant in cassava. The results obtained in this study for number of tillers per plant and market yield per plot were similar with the finding of Pradhan *et al.* (2011) in potato.

Yield parameters

Different genotypes exhibited significant differences for the number of tubers per plant in arrow root during both the years of study. During the year 2021, the genotype Tar 18-5 recorded maximum number of tubers per plant (14.33), which was statistically at par with Tar 18-12 (14.00), Tar 18-14 (12.00). Whereas, minimum number of tubers per plant (7.33) was recorded in Tar 18-4, it was found to be on par with Tar 18-11 (8.00) and Tar 18-1 (8.67). Similarly in the year 2022, it has been observed that the genotype Tar 18-4 recorded minimum number of tubers per plant (9.38), which was statistically

Table 1 : Performance of different Arrow root entries for growth parameters.

Entries	Plant height (cm)			Number of Tillers plant^{-1}		
	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled
Tar 18-1	115.96	122.29	119.13	12.00	13.26	12.63
Tar 18-4	110.28	116.69	113.48	8.33	11.20	9.77
Tar 18-5	116.27	123.24	119.76	13.00	14.21	13.61
Tar 18-10	111.88	118.02	114.95	11.00	12.11	11.56
Tar 18-11	101.14	111.05	106.09	9.67	10.82	10.25
Tar 18-12	110.86	117.38	114.12	10.67	12.13	11.40
Tar 18-14	110.28	117.09	113.68	9.33	11.00	10.17
Mean	**110.95**	**117.96**	**114.46**	**10.57**	**12.11**	**11.34**
S.Em ±	4.70	4.52	4.21	0.90	0.91	0.86
CD (5%)	14.48	13.56	12.63	2.78	2.81	2.64
CV (%)	11.10	13.56	12.35	14.77	13.04	13.09

Table 2 : Performance of different Arrow root entries for yield parameters.

Entries	Number of tubers plant^{-1}			Tuber yield (t ha^{-1})			Biggest tuber weight (g)		
	2021-22	2022-23	Pooled	2021-22	2022-23	Pooled	2021-22	2022-23	Pooled
Tar 18-1	8.67	11.34	10.01	20.43	22.02	21.23	126.33	128.74	127.54
Tar 18-4	7.33	9.38	8.36	16.01	17.22	16.62	109.67	112.09	110.88
Tar 18-5	14.33	17.05	15.69	25.14	27.17	26.15	144.00	146.81	145.41
Tar 18-10	11.00	13.21	12.11	22.41	24.21	23.31	133.33	136.25	134.79
Tar 18-11	8.00	10.68	9.34	17.38	18.16	17.77	122.67	126.95	124.81
Tar 18-12	14.00	16.91	15.45	22.69	24.52	23.60	125.00	127.47	126.24
Tar 18-14	12.00	14.80	13.40	23.13	23.50	23.31	140.33	145.75	143.04
Mean	10.76	13.34	12.05	21.03	22.40	21.71	128.76	132.01	130.39
S.Em ±	1.09	1.16	1.10	1.77	2.27	2.01	6.20	6.51	6.33
CD (5%)	3.36	3.57	3.38	5.45	6.98	6.19	19.11	20.07	19.50
CV (%)	17.54	15.06	15.77	14.58	17.52	16.02	8.34	8.55	8.41

at par with Tar 18-11 (10.68) and Tar 18-1 (11.34). Whereas, maximum number of tubers per plant (17.05) was found in genotype Tar 18-5, followed by the Tar 18-12 (16.91). Pooled data was in accordance with individual years.

A cursory glance of Table 2, revealed that different genotypes, significantly influenced the yield ha^{-1} of arrow root for both the years of study. It is inferred from the data presented in the Table 2 that during the both years 2020 and 2021 showed that, significantly maximum yield ha^{-1} (25.14 and 27.17 t, respectively) was obtained in genotype Tar 18-5 as compared to rest of the genotypes, but was found in parity with genotype Tar 18-14 (23.13 and 23.50 t, respectively) and Tar 18-10 (22.41 and 24.21 t, respectively). While, least yield ha $^{-1}$ (16.01 and 17.22 t, respectively) was observed in Tar 18-4. On the basis of pooled data of both the years, significantly maximum yield ha^{-1} (26.15 t ha^{-1}) was recorded in genotype Tar 18-5, which was statistically at par with Tar 18-12 (23.60 t ha^{-1}). However, minimum yield (16.62 t ha^{-1}) was registered in treatment with Tar 18-4. This indicated that presence of a greater number of tillers will increases the rhizome yield per plant. The finding was supported with the results obtain by Khayatnezhad *et al*. (2011) in potato. Similar report was recorded by Teshome *et al*. (2004), Mishra *et al*. (2006), Sattar *et al*. (2007), Haydar *et al*. (2009) in potato.

Among the different genotypes, significantly biggest tuber weight was recorded with genotype Tar 18-5 (145.41 g) as compared to rest of the genotypes, followed by Tar 18-14 (143.04 g). Significantly lower biggest tuber weight was noticed in Tar 18-4 (110.88 g).

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