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Performance of *Dioscorea alata* Entries in Chhattisgarh under Multi Location Trial

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A B S T R A C T

An investigation under multiplication trial (MLT) was conducted to evaluate the entries of *Dioscorea alata* locally known as Ratalu and Nagar Kanda under different agroclimatic zones of Chhattisgarh in rainfed condition to identify the high tuber yielding genotype of Ratalu. The experiment was conducted during Kharif 2015-16 and 2016-17 at five locations under Bastar Plateau, Northern Hill Region and Plains of Chhattisgarh with five genotypes including standard and local check under AICRP on Tuber Crops. The locations were the replications in the experiment. The experiment was laid out in Randomized Complete Block Design (RCBD) with five treatments viz. IGDa-2, Da-25, IGDa-4, Sree Karthika (St. Check) and IGDa-1 (Local check) with five replications viz. L_1: Jagdalpur, L_2: Dantewada, L_3: Narayanpur, L_4: Jashpur and L_5: Rajnandgaon. Among the 05 entries of *Dioscorea alata* evaluated the entry IGDa-2 recorded highest tuber yield (26.56 t. ha^{-1}) as compare to standard check Sree Karthika (20.70 t. ha^{-1}) and Local check IGDa-1 (13.64 t. ha^{-1}) which was significantly superior to all over the genotypes. The highest dry matter content (36.08 %) and crude protein (10.33 %) was recorded in entry Da-25. The promising entry IGDa-2 given 28.31 % higher tuber yield as compare to standard check Sree Karthika and 94.72 % as compare to local check IGDa-1. The promising entry IGDa-2 recorded highest organopeptic score (8.62), resistant for anthracnose disease and have excellent cooking quality as compare to local check. The entry IGDa-2 considered as promising genotypes of *Dioscorea alata* and it may be recommended for commercial cultivation in Chhattisgarh under rainfed condition.

Introduction

Greater yam (*Dioscorea alata* L.) family: Dioscoreaceae, Commonly known as Ratalu and locally known as Nagar Kanda, Naar Kanda, Ghorana Kanda, Uksa Kanda in Chhattisgarh. Yam is the common term for a number of species in the genus *Dioscorea*. *Dioscorea alata* L. is the important cultivated species of *Dioscorea*. Yam is considered to be the third most important group of dietary staple for low income consumers. Yams are considered second to cassava as the most important tropical root crops, worldwide. *Dioscorea alata* is good source of carbohydrate and one of the richest sources of

energy along with several vitamins and minerals. Yams were grown in India since very ancient times and *D. alata* is said to be of Indian Origin (George and Sunitha, 2018). It is a rich source of carbohydrates, certain vitamins and has high calorific value. Greater yam is a Kharif season crop and grown as rainfed crop. Greater yam is a major tuber crop available in the *Badi* or *Kitchen garden* of the all farmers of Chhattisgarh mostly in tribal districts. Greater yam is a most ethnic tuber crop having more demand in market during November month on *Devuthani* festival in Chhattisgarh. The total area of Greater yam of Chhattisgarh is 216.60 ha with 5833.07 tonnes production and 23.94 t ha^{-1} productivity. Freshly harvested tubers of Greater yam are consumed as boiled, baked, fried and as a vegetable like potato (Shankar and Singh, 2018). Yams and aroids are generally cultivated throughout India as vegetable crops in homestead or semi commercial scale covering an area of about 90,000 ha. The average tuber yield of grater yam in Chhattisgarh is very low as compare to other states of India due to non-popularity as commercial crop, cultivation of local and poor quality indigenous greater yam varieties. At present, there is no any high yielding variety of greater yam for commercial production and large area adoption for farmers. So, it is necessary to develop high yielding greater yam varieties with desirable characters. Earlier, ICAR-CTCRI released two varieties namely 'Sree Roopa, Sree Karthika and Sree Kirthi' giving emphasis only on tuber yield and there was a need for disease resistant, organopetically highly acceptable by farmers as well as high tuber yielding variety. Thus, there was a great demand for tubers of greater yam by the consumers of Chhattisgarh and present demand fulfilling from supply by farmers of Andhra Pradesh and Orissa. In view of these facts AICRP on Tuber Crops, Centre-IGKV, Jagdalpur, Chhattisgarh has started an experiment during the year 2011-12 under coordinated trial with 12 genotypes with standard check. After several year trials with 12 entries four genotypes viz., IGDa-2, Da-25, IGDa-4, Sree Karthika (St. Check) identified for further multi location trials for two years with high yield potential and some desirable qualities. The greater yam genotype IGDa-2 has been identified with high yield potential and some desirable qualities. This variety has been also recommended for release for Chhattisgarh and Gujarat states during annual group meeting of AICRP on Tuber Crops during the year 2017-18 for commercial production by farmers. This paper reports the yield potential, quality and other desirable characters of IGDa-2 with comparison of standard check Sree Karthika and local check IDGa-1.

Materials and Methods

A field experiment was conducted under multiplication trial (MLT) of *Dioscorea alata* entries for consecutive two years (2015-16 & 2016-17) at five diverse locations of Chhattisgarh (L_1: Jagdalpur, L_2: Dantewada, L_3: Narayanpur, L_4: Jashpur and L_5: Rajnandgaon) in rainfed with five genotypes viz. IGDa-2, Da-25, IGDa-4, Sree Karthika (Standard Check) and IGDa-1 (Local check). The experiment was laid out in Randomized Complete Block Design (RCBD) with five treatments. The unit plot size was 4.5 x 4.5 m each accommodating 25 plants in five rows at 90 x 90 cm spacing. The crops were planted on mid-June and harvested on the last week of January in both the seasons. The crop was fertilized at the rate of 10 tonnes of FYM, 80 kg of nitrogen, 60 kg of phosphorus and 80 kg of potash. The adoption trial were also conducted at fermers field in the field of seven farmers at Bastar, Kondagaon, Kanker and Dantewada districts of Chhattisgarh during the year 2017-18. The starch content, dry matter per cent and crude protein were also estimated from tuber of *Dioscorea alata* after

harvesting. Organoleptic test was performed by a panel, considering taste, sweetness, softness, and physical appearance after steam boiling. Data were recorded from 10 randomly selected plants from each plot and analyzed statistically using SAS program.

Results and Discussion

The pooled data of two years on yield and quality performance of the *Diascorea alata* genotypes are furnished in Table 1 and 2 and mean performance on the basis of two year data also given in Table 3. Five genotypes of *Dioscorea alata* including check selected through for testing performance of multi-location trial during 2015-16 and 2016-17. The genotype which performed well in the year 2015-16 (Table 1) under multi location trial, was IGDa-2 with tuber yield 26.56 t. ha^{-1} followed by IGDa-4 (23.51 t. ha^{-1}) and Da- 25 (23.04 t.ha^{-1}). Dry matter content was highest in genotype IGDa – 4 with 36.10% followed by IGDa-2 (35.02%) and Da – 25 (32.59%). The starch content was recorded maximum in Da – 25 which was 26.30% followed by IGDa – 2 (24.74%) and IGDa - 4 (23.32%). The minimum starch contain was recorded in Sree Karthika (21.24%). The highest crude protein was recorded in IGDa-4 with 10.36% followed by IGDa – 1 (local) recorded 8.57% and IGDa – 2 (6.30%). The highest Anthracnose incidence was recorded in genotype IGDa – 1 (4.25) followed by IGDa – 4 (0.25). The organoleptic score was highest in genotypes IGDa – 2 (8.61) followed by IGDa – 4 (7.86) and Da – 25 (6.94).

Among the 05entries of *Dioscorea alata* evaluated during 2016-17 (Table 2) under MLT at five locations/districts of Chhattisgarh, the entry IGDa-2 recorded highest tuber yield (35.88 t. ha^{-1}) with at par IGDa-4 (35.16 t. ha^{-1}) as compare to Standard check Sree Karthika (28.32 t. ha^{-1}). Dry matter content varied from 36.06% to 29.27%. The highest dry matter content (36.06%) was recorded in genotype IGDa – 4 followed by IGDa-2 (35.12%). The starch content was recorded maximum in Da – 25 which was 26.28% and minimum in Sree Karthika (21.16%). The highest crude protein content was recorded in IGDa-4 with 10.30% followed by IGDa – 1 (local) with 8.75% and IGDa – 2 (6.34%). The highest Anthracnose incidence was recorded in genotype IGDa – 1 (3.66) followed by IGDa – 4 (020). The organoleptic score was highest in genotypes IGDa – 2 (8.62) followed by IGDa – 4 (7.75) and Da – 25 (6.74). The pooled data of tuber yield of the four genotypes and the check variety differed at five locations at SG CARS Jagdalpur, KVK-Dantewada, KVK-Narayanpur, KVK-Jashpur and CoH-Rajnandgaon (Table 3). The highest tuber yield (26.56 t. ha^{-1}) was recorded for Genotypes IGDa – 2, which was significantly superior to other genotypes, whereas, lowest tuber yield (13.64 t. ha^{-1}) was recorded in genotype IGDa - 1. This result is also in agreement with Golder *et al.,* 2007.

The dry matter content ranges from 36.08 to 29.46% as means performance of two year data. The maximum dry matter (36.08%) was recorded in entry IGDa – 4 which was significantly superior over the other genotype and minimum dry matter (13.64%) was recorded in IGDa – 1. The starch content under different genotypes was observed to range from 26.29% (Da - 25) to 21.20% (IGDa - 1). Pooled analysis of two years data on crude protein (%) revealed that genotype IGDa – 4 had the significantly highest of 10.33% followed by IGDa – 1 (8.66%) and IGDa – 2 (6.32%). The lowest crude protein content was recorded for the Sree Karthika (5.66%). Regarding organoleptic score of boiled tuber, mean data reveals that genotype IGDa – 2 had the maximum organoleptic score of 8.62 and genotype IGDa – 1 had the minimum of 5.14.

Table.1 Yield and quality attributes of *Dioscorea alata* entries under MLT (2015-16) at Jagdalpur

Entries	Tuber yield (t. ha^{-1})	Tuber Shape	Tuber Flesh Colour	Dry Matter (%)	Starch content (%)	Crude protein (%)	Anthracnose incidence (Score)	Cooking quality	Organoleptic Score (0-9 scale)
IGDa – 2	26.56	Cylindrical Long	Purplish white	35.02	24.74	6.30	0.00	Excellent	8.61
Da – 25	23.04	Round oblong	Cream White	32.59	26.30	5.67	0.00	Very Good	6.94
IGDa – 4	23.51	Long	Dark Cream	36.10	23.32	10.36	0.25	Excellent	7.86
Sree Karthika (St. Check)	20.70	Oblong	Light Purplish white	31.11	21.24	5.71	0.00	Very Good	6.72
IGDa – 1 (Local)	13.64	Long	Yellowish Cream	29.65	21.98	8.57	4.25	Good	5.21
SEm ±	**0.456**	-	-	**0.284**	**0.259**	**0.165**	-	-	**0.226**
CD at (5 %)	**1.378**	-	-	**0.859**	**0.784**	**0.5**	-	-	**0.684**
CV (%)	**4.753**	-	-	**1.932**	**2.465**	**5.053**	-	-	**7.155**

Table.2 Yield and quality attributes of *Dioscorea alata* entries under MLT (2016-17) at Jagdalpur

Entries	Tuber yield (t. ha^{-1})	Tuber Shape	Tuber Flesh Colour	Dry Matter (%)	Starch content (%)	Crude protein (%)	Anthracnose incidence (Score)	Cooking quality	Organoleptic Score (0-9 scale)
IGDa – 2	35.88	Cylindrical Long	Purplish white	35.12	24.83	6.34	0.00	Excellent	8.62
Da – 25	27.55	Round oblong	Cream White	32.68	26.28	5.70	0.00	Very Good	6.74
IGDa – 4	35.16	Long	Dark Cream	36.06	23.08	10.30	0.20	Excellent	7.75
Sree Karthika (St. Check)	28.32	Oblong	Light Purplish white	31.22	21.16	5.60	0.00	Very Good	6.64
IGDa – 1 (Local)	19.56	Long	Yellowish Cream	29.27	21.90	8.75	3.66	Good	5.06
SEm ±	**0.738**	-	-	**0.254**	**0.253**	**0.163**	-	-	**0.231**
CD at (5 %)	**2.230**	-	-	**0.768**	**0.765**	**0.491**	-	-	**0.700**
CV (%)	**5.630**	-	-	**1.727**	**2.414**	**4.953**	-	-	**7.429**

Table.3 Combined analysis of Yield and quality attributes of *Dioscorea alata* entries under MLT (2015-16 & 2016-17) at Jagdalpur

Entries	Tuber yield (t. ha^{-1})	Dry Matter (%)	Starch content (%)	Crude protein (%)	Organoleptic Score (0-9 scale)
IGDa – 2	26.56	35.07	24.79	6.32	8.62
Da – 25	23.04	32.64	26.29	5.69	6.84
IGDa – 4	23.51	36.08	23.20	10.33	7.81
Sree Karthika (St. Check)	20.70	31.17	21.20	5.66	6.68
IGDa – 1 (Local)	13.64	29.46	21.94	8.66	5.14
SEm ±	**0.816**	**0.381**	**0.362**	**0.232**	**0.730**
CD at (5 %)	**1.663**	**0.776**	**0.738**	**0.472**	**1.487**
CV (%)	**5.087**	**2.375**	**2.258**	**1.445**	**4.548**

Table.4 Adoption trial of *Dioscorea alata* genotypes at 07 location in different district of Chhattisgarh in farmers field during the year 2017-18; Genotypes: 1. IGDa-2 & 2. Local (Total Area: 0.5 + 0.07 = 0.57 ha)

S. No.	Name of Farmers	Address	Genotype	Area of Demonstration (ha.)	Tuber Weight per plant (Kg)	Yield t. ha^{-1}
1.	Shri Prasant Baghel	Village- Bodanpal, Block: Bastar, District: Bastar	IGDa-2	0.1	2.30	28.40
			Local	0.01	1.42	14.20
2.	Shri Rajesh Netam	Village-Tatirash, Block-Keshkal, District: Kondagaon	IGDa-2	0.1	1.95	24.07
			Local	0.01	1.30	13.00
3.	Shri Balsingh Mandavi	Village:Gumiyapal, Block: Tokapal, District: Bastar	IGDa-2	0.1	2.75	33.95
			Local	0.01	1.52	15.20
4.	Shri Nandkishor Nag	Village-Mohlai, Block: Bakawand, District: Bastar	IGDa-2	0.1	2.80	34.57
			Local	0.01	1.65	16.50
5.	Shri Murli Mourya	Village: Dilmili, Block: Bastanar, District: Bastar	IGDa-2	0.02	2.10	25.93
			Local	0.01	1.05	10.50
6.	Shri Lekhan Ram Vatti	Village-Mohpur, Block: Kanker, District: Kanker	IGDa-2	0.03	2.25	27.78
			Local	0.01	1.46	14.60
7.	Shri Rati Ram Yadav	Village-Karli, Block: Geedam, District: Dantewada	IGDa-2	0.05	2.35	29.01
			Local	0.01	0.95	9.50
Mean			**IGDa-2**		**2.36**	**29.101**
			Local		**1.33**	**13.36**

Similar finding was also reported by Kanwar *et al.,* (2016) in *Costus speciosus*. The variation in different parameters among the genotypes may be due to genetic potentiality and adaptability (Bhuiyan and Ahmed, 2001). The variation in the yield parameters may be due to the potential of the genotypes to express differently due to variation in soil and climatic conditions of the area of collection (Chongtham *et al.,* 2013), apart from the genetic variation.

Tuber yield of two genotypes significantly differed in the farmer's field at seven locations (Table 4). At village Mohlai genotype IGDa – 2 produced the highest tuber yield (34.57 t. ha^{-1}) and tuber weight per plant (2.80 kg) whereas at village Mohlai genotype Local produced the highest tuber yield and tuber weight per plant (16.50 t. ha^{-1} and 1.65 kg). The mean highest tuber yield obtained from farmer's field was from genotype IGDa – 2 (29.101 t. ha^{-1}) and the second being Local (13.36 t. ha^{-1}) and the yield of this and other varieties reported previously in Bhuiyan *et al.,* 1996 and Bhuiyan *et al.,* 2009.

In conclusion the genotype of Greater yam i.e. IGDa-2 was found highest tuber yielding as compare to standard check Sree Karthika and Local check IGDa-1 and IGDa-2 was significantly superior to all over the genotypes during both the years. The promising entry IGDa-2 given 28.31 % higher tuber yield as compare to standard check Sree Karthika and 94.72 % as compare to local check IGDa-1. The IGDa-2 also recorded highest organopeptic score, resistant for anthracnose disease and has excellent cooking quality as compare to local check.

The genotype IGDa-2 can be exploited in Chhattisgarh state and it may be recommended for commercial cultivation in Chhattisgarh under rainfed condition for food and nutritional security.

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