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# Evaluation of some indigenous banana genotypes of Odisha

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**Abstract**
The present investigation was undertaken to evaluate some indigenous banana genotypes of Odisha. Eight indigenous banana genotypes of Odisha were evaluated in a randomized block design with three replication during the year 2018-19. Observations were recorded on growth parameters, yield attributing traits and quality parameters. Analysis of variance indicated significant differences among the genotypes in respect of all the characters studied. The results revealed that maximum pseudostem height of 312.80 cm and girthof 73.40 cm were recorded in Koraput Champa at the time of shooting. The highest number of suckers was produced by Banua (8.46) whereas highest number of leaves at the time of shooting was produced by Champa (12.13). Comparatively early shooting and harvesting was obtained in Singapuri (255.33 and 333.33 days) whereas late shooting and harvesting was recorded in Kathia Champa(379.00 and 451.33 days). Regarding yield parameters highest bunch weight (14.50 kg), bunch length (61.33 cm), bunch girth (88.35 cm), finger weight (129.40 g), finger girth (16.76 cm) and yield (36.26 t/ha) were obtained from Koraput Champa. However Singapuri recorded the maximum finger length of 22.97 cm. With respect to quality parameters highest TSS, reducing sugar and total sugar were recorded in Koraput Champa. Regarding shelf life result revealed that Banua recorded the maximum shelf life of 9.23 days and lowest shelf life was recorded in Mazapuri (5.16 days). Keeping the observations in mind Koraput Champa was found to be superior in all aspects.

**Keywords:** dessert banana, growth parameters, yield, quality, evaluation, odisha

## Introduction
Banana belongs to the family Musaceae of order Zingiberales. It is valued worldwide for its excellent flavour, nutritional value, and its availability throughout the year. Banana is rich source of major vitamins like vitamin –A, B and C. Also banana contains lots of potassium, natural sugars, proteins and a little quantity of fat. It is easy to digest and therefore acts as a choicest food of many of the professional athelets. Banana may be of world's oldest fruit crop. Its cultivation dates back to prehistoric time in India. The term "banana" was introduced from the Guinea coast of West Africa by the Portuguese, while the term"plantain"(cooking bananas) was derived from "plantano" of the Spaniards (Purseglove,1975).

Banana is highly diversified throughout the world but reported from South-east Asia. Banana and plantains are cultivated over 130 countries mostly in the tropical and subtropical regions of the world. *Musa* consists of around 50 species. North India is considered as the richest source of banana diversity.

In India banana is regarded as "Kalpatharu", a plant of all virtues as each and every part is used for specific purpose. Fruits are used for dessert and culinary purpose. Fruits have enormous medicinal property. It helps in reducing risk of heart diseases as well as high blood pressure. It is also recommended for the patients suffering from ulcer, kidney diseases. Banana fruits also contain high content of iron which helps in production of haemoglobin in blood. Banana skins are rich source of vitamins and helps to cure retina related problems. It plays a significant role in Indian weddings. Leaves are commonly used as hygienic biological plates and gaining popularity in South India. Even state Tamilnadu is growing banana only for leaf purpose. The inner core of pseudostem and male buds are used as vegetables. Banana powder is used as baby food. Some processed food products such as chips, banana puree, jam, jelly, wines etc can be made from the fruits. Pseudostem is used as a lifesaving raft during

flooding. Banana fibre is used to make items like bags, pots and wall hangers. Banana waste can be converted in to rope and various good quality paper.

Banana growing areas in Odisha are Puri, Khurdha, Cuttuck, Bhadrak, Anugul, Dhenkanal, Kalahandi.The varieties grown in Odisha are Champa, Patkapura, Batisha, Dakhina Sagar, ChiniChampa, Red Banana, Grand Naine, Bantala etc. Banana has always proved to be better crops for horticultural farmers. Even in poor condition, banana gives a useful crop and contributes to food security. Hence the present investigation was undertaken to evaluate some indigenous dessert banana genotypes of Odisha.

## Materials and methods

The present experiment was carried out at All India Coordinated Research Project on Fruits (Banana), Horticultural Research Station, OUAT, Bhubaneswar during the year 2018-19. It lies between $20.27^0$ North latitude and $85.84^0$ East longitude and at an average altitude of 450 m above mean sea level.The experiment was laid out in randomized block design (RBD) with eight indigenous cultivars replicated for three times. Each genotype contained fifteen numbers of plants. The suckers of eight cultivars i.e Kathia Champa (AAB), Koraput Champa (AAB), Singapuri(AAA), Khandachini (AAB), Mazapuri (AAB), Banua(ABB), Sankara (AAB) and Champa (AAB) were collected from Cuttack, Koraput, Bhadrak, Ganjam, Puri and Khurdha district and planting was done on 18th of January 2018 at a spacing of 2m×2m following all recommended package of practices.

Ten healthy plants were randomly selected from each treatment to record height of the pseudostem, girth of the pseudostem, number of suckers, number of leaves, leaf length, leaf width, leaf area (by multiplying average leaf length and area with a factor 0.8 ( Summerville, 1944), days to shooting and days to harvest**.** For yield and yield attributing characters length of bunch, girth of bunch, number of hands, length of finger, girth of finger, finger weight and bunch weight was taken. For qualitative parameters TSS was measured by means of hand refractometer. Total acidity content and sugar content was estimated by using The reducing sugar was determined by the method proposed by A.O.A.C (1980). Regarding shelf life fruits were stored under normal temperature condition of $25^0$ C to $30^0$ C and relative humidity of 70-80%. The end of the shelf life was decided when more than 50% of fruits start shrivelling.

### Statistical Data analysis

Statistical Analysis Data were subjected to Analysis of Variance (ANOVA) statistical analysis using Statistical Analysis System (SAS), according to the procedure outlined for randomized block design (RBD) using SAS 9.2 version (2009).

## Result and discussion

Koraput Champa recorded the maximum pseudostem height of 312.80 cm while minimum was recorded by Singapuri (145.33cm)(Table 1). Similar variation was observed by Kavitha *et al.* (2009).The pseudostem height was recorded in the range of 246.1-387.0 cm. Similar varietal evaluation was carried out by Medhi *et al.*(1994), Biswal *et al*. (2004), Dinesh Kumar *et al*. (2012) and Sagar *et al*. (2014).The pseudostem girth was maximum in Koraput Champa (73.40 cm) and minimum in Singapuri (45.90 cm) (Table 1). The variation in pseudostem height and pseudostem girth might be due to genetic inbuilt capacity of different genotypes, might be due to genotype and environment interaction or might be affected by the nutrient uptake capacity of different genotypes. Banua recorded the highest number of suckers (8.46) where as Mazapuri produced the lowest number of suckers (3.63) (Fig.1). Probably sucker production is a varietal character and it is affected by various environmental factors. Previously Biswal *et al.* (2004) and Blomme*et al*. (2000) studied about the variability in sucker production capacity in different culinary banana cultivars.

The number of functional leaves at the time of shooting varied from 8.66-12.13 (Table 1). The check cultivar Champa produced the highest number of leaves (12.13) where as Singapuri produced the lowest number of leaves (8.66). Banana plants with more number of leaves and more area might help in photosynthesis. So these plants might develop better by utilising the photosynthates. Maximum leaf area was observed in Singapuri (0.69 $m^2$) and minimum was being recorded in Khandachini (0.42 $m^2$). This might be due to maintenance of upright growth habit which might have allowed the maximum light interception. Leaf length might have contributed to increase in area. The wide range of variation found in different genotypes corroborates with the findings of Biswal *et al*. (2004), Suvittawat *et al*. (2014) and Sagar *et al*. (2014).

Regarding leaf length Singapuri recorded the highest length of 141.40 cm where as Khandachini recorded the lowest (102.03 cm). Maximum leaf width was recorded in Singapuri (62.87 cm) and minimum was recorded in Sankara (50.96 cm).With respect to phyllochron highest number of days are required for Banua (9.96 days) and lowest was found in KathiaChampa (5.5 days).The wide range of variation found in different indigenous genotypes almost corroborates with the research findings of Sirisena and Senanayake (2000), Uma *et al.* (2000), Rajamanickam *et al*. (2007), Sagar *et al*. (2014) and Karuna and Rao (2016).

**Table 1:** Performance of banana genotypes w.r.t pseudostem height, pseudostem girth at shooting and leaf characteristics.

| Genotypes | Pseudostem height at shooting (cm) | Pseudostem girth at shooting (cm) | Number of leaves at shooting | Phyllochron (in days) | Leaf length at shooting (in cm) | Leaf width at shooting (in cm) | Leaf area at shooting (in $m^2$) | Petiole length at shooting (in cm) |
|---|---|---|---|---|---|---|---|---|
| $G_1$-Kathia Champa | 309.83 | 67.86 | 10.13 | 5.63 | 126.66 | 54.20 | 0.54 | 32.46 |
| $G_2$-Koraput Champa | 312.80 | 73.40 | 11.23 | 7.16 | 137.56 | 52.86 | 0.56 | 37.63 |
| $G_3$-Singapuri | 145.33 | 45.90 | 8.66 | 6.60 | 141.40 | 62.87 | 0.69 | 37.40 |
| $G_4$-Khandachini | 267.50 | 58.50 | 11.23 | 5.73 | 102.03 | 55.10 | 0.44 | 31.56 |
| $G_5$-Mazapuri | 236.10 | 70.56 | 9.10 | 6.36 | 125.20 | 53.33 | 0.53 | 37.00 |
| $G_6$-Banua | 295.36 | 69.16 | 11.06 | 8.90 | 130.63 | 62.60 | 0.65 | 38.33 |
| $G_7$-Sankara | 203.26 | 50.83 | 9.20 | 8.03 | 120.76 | 50.96 | 0.49 | 32.80 |
| $G_8$-Local Champa (Check) | 254.33 | 55.43 | 12.13 | 6.73 | 118.36 | 53.00 | 0.50 | 40.36 |
| SE(m)± | 6.98 | 1.06 | 0.32 | 0.30 | 1.65 | 2.45 | 0.01 | 1.57 |
| CD at 5% | 21.38 | 3.27 | 0.98 | 0.91 | 5.06 | 7.51 | 0.03 | 4.80 |

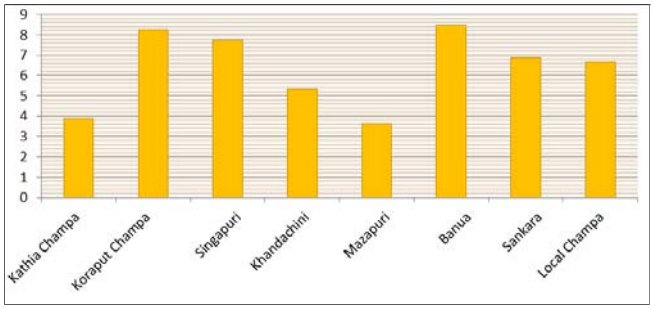


**Fig 1:** Number of suckers at shooting time

Among the cultivars, Singapuri took the lowest day for shooting i.e 255.33 days and Kathia Champa took highest 379.00 days for shooting (Table 2). The same trend was also observed in case of days taken for harvesting. This might be due to genetic characteristics of different cultivars or might be affected by nutrient uptake capacity. Obiefuna *et al.* (1991) evaluated five plantains over two years and reported that flowering period varies from 9 to 12 months after planting. Gonzalez *et al.* (1990) and Suvittawat*et al.* (2014) also found the varietal variation w.r.t days for harvesting in a similar manner.

**Table 2:** Performance of banana genotypes w.r.t days to shooting and days to harvest.

| Genotypes | Days to shooting | Days to harvest |
|---|---|---|
| $G_1$-Kathia Champa | 379.00 | 451.33 |
| $G_2$-Koraput Champa | 291.23 | 375.33 |
| $G_3$-Singapuri | 255.33 | 333.33 |
| $G_4$-Khandachini | 325.2 | 409.36 |
| $G_5$-Mazapuri | 264.66 | 380.00 |
| $G_6$-Banua | 312.83 | 405.56 |
| $G_7$-Sankara | 336.76 | 415.36 |
| $G_8$-Local Champa (Check) | 257.23 | 354.33 |
| SE(m)± | 2.88 | 2.01 |
| CD at 5% | 8.79 | 6.15 |

**Yield and yield attributing characters**

There was a significant variation among the genotypes w.r.t these yield attributing characters. Local Champa recorded the highest number of hands per bunch (11.30) followed by Banua (9.33) and lowest was observed in Banua (7.13) (Table 3). The same trend was also followed for number of fingers per bunch but lowest number of fingers were found in Singapuri (96.16). These findings are in line with Medhi *et al.* (1994) and Biswal *et al*. (2004). In the present study Koraput Champa recorded the highest bunch length (61.33 cm) and the highest bunch girth (88.35 cm). This might be due to more number of fingers per bunch. Singapuri recorded the highest finger length of 22.97 cm. The highest finger girth was found in Koraput Champa (16.76 cm). Similar experiments were carried out by many scientists at national and international level. Further there was almost no disease pest infestation in many of the genotypes and that might have boosted their yield or bunch bearing capacity as the plants were able to complete their physiological processes. These characters might be genetically controlled or might be controlled by planting time, environment and some other factors (Prasanna and Aravindakshan, 1990). Obiefuna*et al.* (1990), Perez *et al*. (2002), Sarkar *et al*. (2005), Ara *et al*. (2011), Karuna and Rao (2016), Baruah *et al*. (2007), Tak *et al.* (2015) and Ravi and Mustaffa (2013) also studied about different yield parameters in banana.

Genotype Koraput Champa indicated highest bunch weight of 14.50 kg followed by Banua (13.65 kg). Minimum bunch weight was observed in Sankara (8.89 kg). More number of leaves at the time of harvesting might have helped in accumulating more photosynthates and in achieving higher bunch weight. The increase in bunch weight could be the result of an increase in bunch length or might be bigger finger size was the major factor contributing to the bunch weight. Hence, the increased bunch weight might have positive relationship with number of hands per bunch, number of fingers per bunch, pseudostem girth and number of leaves per plant at time of shooting.

**Table 3:** Performance of banana genotypes in respect of yield ad yield attributing chaaracters

| Genotypes | Bunch weight (kg) | Bunch length (cm) | Bunch girth (cm) | Numbers of hands per bunch | Number of fingers per bunch | Yield (t/ha) | Finger Weight (g) | Finger length (cm) | Finger girth (cm) |
|---|---|---|---|---|---|---|---|---|---|
| $G_1$-Kathia Champa | 12.96 | 59.34 | 69.37 | 10.98 | 135.00 | 32.40 | 67.06 | 11.45 | 10.33 |
| $G_2$-Koraput Champa | 14.50 | 61.33 | 88.35 | 9.40 | 112.33 | 36.25 | 129.40 | 17.06 | 16.76 |
| $G_3$-Singapuri | 11.16 | 54.93 | 71.00 | 7.66 | 96.16 | 27.90 | 115.06 | 22.97 | 11.50 |
| $G_4$-Khandachini | 10.46 | 53.43 | 67.54 | 9.00 | 110.53 | 26.15 | 90.27 | 12.50 | 11.10 |
| $G_5$-Mazapuri | 9.00 | 48.43 | 65.42 | 9.33 | 121.36 | 22.50 | 78.32 | 13.10 | 10.43 |
| $G_6$-Banua | 13.65 | 56.31 | 69.71 | 7.13 | 114.33 | 34.12 | 120.93 | 15.46 | 13.50 |
| $G_7$-Sankara | 8.89 | 51.03 | 66.31 | 8.4 | 121.43 | 22.22 | 57.50 | 12.80 | 10.93 |
| $G_8$-Local Champa (Check) | 11.96 | 54.71 | 68.31 | 11.3 | 150.66 | 29.90 | 69.43 | 13.57 | 12.07 |
| SE(m)± | 0.25 | 0.27 | 1.89 | 0.34 | 1.03 | 0.51 | 0.52 | 0.24 | 0.23 |
| CD at 5% | 0.77 | 0.85 | 5.81 | 1.04 | 3.18 | 1.56 | 1.59 | 0.72 | 0.70 |

**Quality parameters**

The quality parameters in the present study included pulp to peel ratio, TSS, reducing sugar, total sugar and acidity. The values for pulp weight ranged between 45.30 g to 102.60 g and peel weight ranged between 10.10 to 29.93 g. Maximum and mimimum pulp to peel ratio was obtained from check Champa (5.87) and Banua (3.04) respectively (Fig. 8). This findings are in line with Burdon *et al.* (1993), Valasa Kumar and Nair (2001) and Ravi and Mustaffa (2013).

In the survey, Koraput Champa recorded the highest TSS of $24.5^0$ brix and lowest was recorded by Mazapuri ($18.8^0$ brix) (Table 4). High TSS might have positive effect on various other factors. Sugar is the main component of soluble solids in banana and the data indicate that most of local cultivars of Odisha were comparatively richer in sugar which is one of the most important factors attributing to the fruit quality. TSS content of fruit might be affected by different banana varieties/line or different planting seasons (Ara *et al*, 2011). Increase in the TSS of banana during ripening was also noticed by Uma *et al*. (1999) and Uazire *et al*. (2008). Koraput champa recorded the highest reducing sugar content (18.53 %) (Table 4) and total sugar content of 21.06 %. Among the genotypes, local Champa and Khandachini recorded the highest acid content of 0.33% and minimum was being recorded by Koraput Champa (0.13%). Acidity is one of the important determinants of eating quality and the fruit taste is decided by the balance between sugar and acid. Similar experiments were previously carried out by Sabeena (2000) and Chadha and Dass (2002).

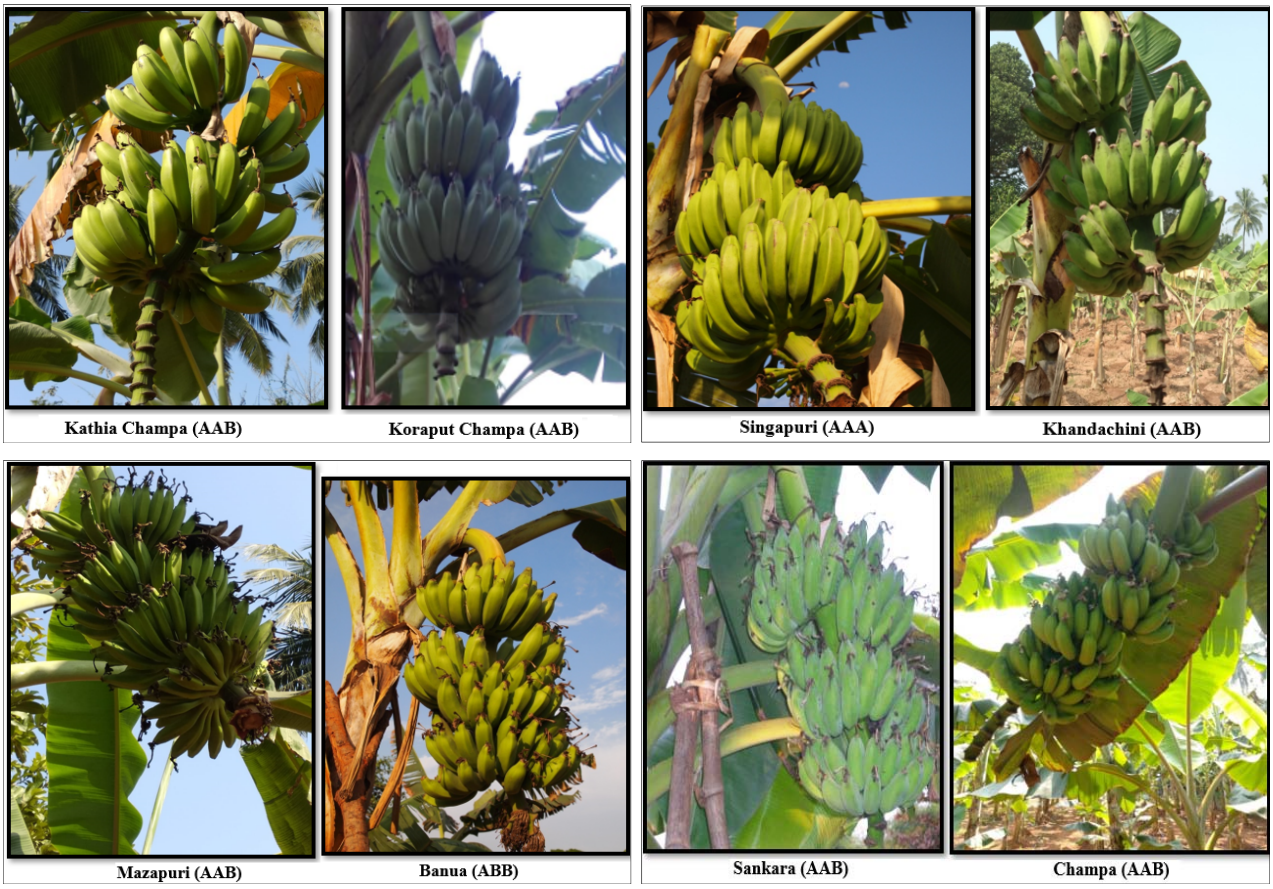


**Fig 2:** Bunches of different indigenous banana cultivars of Odisha

**Table 4:** Performance of banana genotypes w.r.t quality parameters like shelf life, TSS, titrable acidity, reducing sugar and total sugar

| Genotypes | Shelf life(days) | TSS ($^0$ brix) | Titrable acidity (%) | Reducing Sugar (%) | Total Sugar (%) |
|---|---|---|---|---|---|
| $G_1$-Kathia Champa | 6.26 | 21.50 | 0.23 | 15.33 | 20.63 |
| $G_2$-Koraput Champa | 7.14 | 24.50 | 0.13 | 18.53 | 21.06 |
| $G_3$-Singapuri | 6.73 | 19.50 | 0.14 | 10.46 | 14.23 |
| $G_4$-Khandachini | 5.46 | 23.40 | 0.33 | 11.36 | 13.60 |
| $G_5$-Mazapuri | 5.16 | 18.80 | 0.16 | 13.56 | 16.83 |
| $G_6$-Banua | 9.23 | 22.50 | 0.20 | 17.60 | 20.56 |
| $G_7$-Sankara | 6.10 | 19.60 | 0.16 | 8.75 | 12.20 |
| $G_8$-Local Champa (Check) | 6.43 | 21.23 | 0.33 | 13.79 | 16.86 |
| SE(m)± | 0.23 | 0.41 | 0.03 | 0.11 | 0.16 |
| CD at 5% | 0.71 | 1.27 | 0.10 | 0.34 | 0.49 |

**Economics**

The benefit cost ratio was calculated and the data have been presented in Table 5. From the investigation it was observed that maximum net return of Rs. 4,90,00 and B:C ratio of 3.08 was recorded in Koraput Champa. Banua was the second best genotype with net return of Rs. 2,76,800 and B.C ratio of 2.18.

**Table 5:** Economics of different banana genotypes

| Genotypes | Yield (t/ha) | Cost of cultivation (Rs./ha) | Gross income (Rs./ ha) | Net income (Rs./ha) | B:C ratio |
|---|---|---|---|---|---|
| $G_1$-Kathia Champa | 32.40 | 2,35,000 | 4,86,000 | 2,51,000 | 2.06 |
| $G_2$-Koraput Champa | 36.25 | 2,35,000 | 7,25,000 | 4,90,000 | 3.08 |
| $G_3$-Singapuri | 27.90 | 2,35,000 | 4,18,500 | 1,83,500 | 1.78 |
| $G_4$-Khandachini | 26.15 | 2,35,000 | 3,92,250 | 1,57,250 | 1.66 |
| $G_5$-Mazapuri-5 | 22.50 | 2,35,000 | 3,37,500 | 1,02,500 | 1.43 |
| $G_6$-Banua | 34.12 | 2,35,000 | 5,11,800 | 2,76,800 | 2.18 |
| $G_7$-Sankara | 22.22 | 2,35,000 | 3,33,300 | 98,300 | 1.41 |
| $G_8$-Local Champa (Check) | 19.90 | 2,35,000 | 4,48,500 | 2,13,500 | 1.90 |

**Conclusion**

From the experiment it is confirmed that significant amount of variation is present in the existing population which could be further utilised in a better way to enhance the productivity. Koraput Champa recorded best in terms of yield and yield attributing characters with maximum B.C ratio. Similarly Banua was found to be at par with Koraput Champa w.r.t yield and yield attributing characters. Hence it may also be tried by the commercial farmers.

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