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Studies on crop duration and shelf life of different banana genotypes under northern dry zone of Karnataka

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Abstract
A field experiment was conducted to study the performance of different banana genotypes with respect to crop duration and shelf life under northern dry zone of Karnataka. Twenty three genotypes *viz.*, Karibale, Kayipallebale, Rajapuri, Red banana, Rasabale, Elakkibale, Kanayibanasi, Mitli, Bargibale, Balbisiana, Pisanglilin, FHIA-3, Lalchakrakeli, Basrai Dwarf, Monthon, Robusta, Kadali, YangaviKM-5, Sakkarebale, Karpuravalli, Poovan, Pisangawak and Hanuman were evaluated. The genotype Mitli taken minimum days for flowering (211 days), thus short crop duration (304.06 days), and also recorded the shortest green life (5.67 days), shortest yellow life (3.33 days) and thus the shortest shelf life (9.00 days). The maximum days (377.76) taken to flowering was observed in Karpuravalli. Elakkibale recorded the minimum days from flowering to harvesting (71.33 days) and maximum in (151.33days) Kadali. The maximum (524.18 days) plant duration, longest green life (15.66 days) and longest shelf life (22.33 days) was observed in Balbisiana. The longest yellow life (6.67days) was observed in the genotype Poovan. Among the genotypes studied with respect to crop duration Mitli genotype performed better and Balbisiana showed maximum shelf life

Keywords: Genotype, crop duration, shelf-life and banana

Introduction
Banana (*Musa* sp.) is a large perennial herb with leaf sheaths that form trunk like pseudostem. Banana has its origin in tropical region of South East Asia. Banana is a nutritious gold mine. The edible banana has been evolved by two wild progenitors' *viz*. *Musa acuminata* and *Musa balbisiana* (Simmonds and Shaphered 1955). One of the most crucial phases in development in flowering plants is the decision to flower. The timing of flowering has a major influence on plant fitness. Flowering is controlled by several external factors such as photoperiod, temperature, abiotic stresses and internal factors like hormone levels, C/N ratios and age of the plant. The long life cycle predisposes it to abiotic stresses such as high tropical summer temperatures coupled with reduced water availability or low winter temperatures with occasional frost that affect yields.

Banana is an important day neutral food crop with a long flowering/fruiting cycle that is affected by hot summers or cold winters in different places (Chaurasia *et al*., 2017) [3]. From 26 to 32 banana leaves will have wrapped around themselves by the time the inflorescence emerges from the center of the pseudostem. Banana shoots grow best at 78 to 82 F and the bananas grow at 84 to 86 F. Between 32 and 60 F, bananas may be injured, which can cause the failure of the inflorescence to emerge from the pseudostem or greenish-gray or dull yellow, distorted fruit. Temperature below 28 degree F may kill banana plants. Flowering and fruiting times depend upon banana variety. The banana plant needs 6 to 8 months to produce a single flower stalk (Santosh *et al.*, 2017) [8]. It takes an additional four to six months for the fruits to ripen. Around the world, bananas are one of the most popular tropical fruits.

Despite their popularity, bananas have a relatively short shelf life that creates challenges for both producers and consumers. Ripening is a process, which increases the quality of the fruit, and it is part of the same process, which is accelerating the product towards post-market senescence (Ferris, 1991) [4]. Green-life of climacteric fruit has been defined by Peacock and Blake (1970) [6] as the time that elapses between harvest and the onset of the respiratory climacteric, under defined conditions. During ripening, plantain and banana peel turns to lighter green, and then to yellow as chlorophyll is broken down, and during colour change the pulp becomes softer and sweeter as the ratio of sugars to starch increases (Robinson, 1996) [7]. Fruit also losses its astringency and develop characteristic flavor (Thompson and Burden, 1995) [13]. The respiration rate subsequently decreases progressively to reach zero at the

physiological death of the fruit. Eventually the peel becomes spotted brown or black and the pulp loses its firm texture and white or yellow coloration to become brown and gelatinous (Robinson, 1996) [7]. Fruit of many of the cooking genotypes had a significantly longer shelf life than that of the desert banana.

In banana, post-harvest compositional changes following are important since banana is a climacteric fruit. Dramatic changes in banana peel colour and pulp texture occur during the rise in respiration during storage of climacteric fruits. The changes occurred during ripening are in physical, mechanical and chemical properties of banana fruits. Skin colour changes from green to yellow, firmness is decreased, fruit gets softened and starch is converted into sugar. Mainly colour changes in banana during ripening is based on the peel colour rather than the pulp colour and hence colour of banana peel has been used in the assessment of the stages of ripeness of banana (Tapre and Jain 2014) [12].

Banana is one of the most important food and cash crops in Karnataka. A large number of banana cultivars are grown in North Karnataka. Though North Karnataka is having congenial condition for commercial cultivation of banana, the average yield obtained is not satisfactory compared to many other states because lack of knowledge in selecting the good varieties and less knowledge in manipulation of the flowering time in banana is thus of primary interest so as to shorten the vegetative phase and thereby conserve water particularly during the hot tropical summers or reduce frost injury in winters and can escape from pest and disease and thereby produce good quality fruits and finally increases the yield. Consumers use visual quality to purchase fresh produce (Shewfelt, 2009) [10]. Market returns for bananas in international markets are generally greatest for large fruit that are blemish-free (Johns, 1996) [5]. Shelf life also plays an important role in postharvest attribute on which their conservation on commodity chains depends, especially when there is a need for transport between the producing and the selling area. The present study aimed to investigate the crop duration and shelf life of plantain and banana genotypes under Northern Dry Zone of Karnataka to complement breeding strategy, post-harvest handling and utilization, as well as marketing.

Materials and Methods

A field study was conducted with twenty three genotypes and sufficient number of bunches were tagged at the fruit set stage at Sector 70 fruit orchard College of Horticulture, Bagalkot, Karnataka during 2012-2014. Genotypes like., Karibale, Kayipallebale, Rajapuri, Red banana, Rasabale, Elakkibale, Kanayibanasi, Mitli, Bargibale, Balbisiana, Pisanglilin, FHIA-3, Lalchakrakeli, Basrai Dwarf, Monthon, Robusta, Kadali, YangaviKM-5, Sakkarebale, Karpuravalli, Poovan, Pisangawak and Hanuman were used for evaluation. One genotype was considered as a treatment and each treatment and was replicated thrice. The experiment was carried out in a Completely Randomized Design. The number of days required from planting to shooting (duration in days) was recorded. The number of days required from shooting to harvest and planting to harvest (duration in days) was recorded and the number of days taken from planting to harvesting (duration in days) was recorded. Shelf life of fruits was decided based on the appearance and marketability of the fruits. When the fruits attained beyond edible ripe stage, then those fruits were considered to have reached the end of their shelf life.

Results and Discussion

The results in respect to shelf life

are presented in Table 2 that number of days taken from planting to shooting differed significantly among the genotypes. An early shooting (211.00days) was recorded in genotype Mitli, followed by the genotype Pisanglilin (226.33 days) and the maximum (377.76 days) number of days taken to shooting was in Karpuravalli.

Number of days taken from shooting to harvesting

The data showed that number of days taken from planting to harvesting differed significantly an early harvesting (71.33 days) was recorded in genotype Elakkibale, which was on par with Kanayibanasi (74.66 days), Basrai Dwarf (77.00 days) and Rasabale (81.00 days) and the more number of days (151.33days) taken for harvesting was in Kadali.

Plant duration

The minimum crop duration was recorded in the genotype Mitli (304.06 days) which was on par with the genotypes Elakkibale (354.10), Kanayibanasi (354.11 days), Pisangawak (354.26 days), Pisanglilin (354.46 days), Monthon (355.00 days) and Lalchakrakeli (355.23 days) where as the maximum plant duration was observed in Balbisiana (524.18 days).This might be due to its earliest shooting and harvesting time helps in reducing the duration of the plant. The results are in contrast with Ara *et al.* (2011) [2].

Table 1: Performance of banana genotypes in respect of plant duration

Treatment	No. of days taken from planting to shooting	No. of days taken from shooting to harvesting	Plant duration
T_1–Karibale (AAA)	256.67	103.33	360.00
T_2 - Kayipallebale (ABB)	258.67	102.00	360.33
T_3 –Rajapuri (AAB)	258.67	104.33	362.90
T_4 - Red banana (AAA)	367.00	93.00	461.56
T_5 – Rasabale (AAB)	282.67	81.00	363.06
T_6 – Elakkibale (AB)	283.67	71.33	354.10
T_7–Kanayibanasi (AAA)	280.33	74.67	354.11
T_8–Mitli (AB)	211.00	93.00	304.07
T_9–Bargibale (AAB)	267.00	90.67	356.84
T_{10} - Balbisiana (BB)	377.33	147.67	524.19
T_{11}–Pisanglilin(AA)	226.33	128.67	354.47
T_{12} -FHIA 3 (AABB)	319.33	140.67	459.40
T_{13} –Lalchakrakeli (AAA)	263.67	91.33	355.23
T_{14} -Basrai Dwarf (AAA)	285.00	77.00	362.77
T_{15} –Monthon (ABB)	254.00	101.0	355.00

T_{16} –Robusta (AAA)	355.67	104.33	458.70
T_{17} -Kadali (AA)	333.67	151.33	484.86
T_{18} -Yangavi KM -5 (AAA)	292.33	84.67	376.23
T_{19} - Sakkarebale (AB)	274.00	88.67	362.43
T_{20}–Karpuravalli (AAB)	377.67	147.33	520.07
T_{21} - Poovan (AAB)	288.67	98.67	386.08
T_{22}– Pisangawak (ABB)	268.67	86.33	354.26
T_{23} - Hanuman (AAA)	376.33	148.67	524.08
F- test	**	**	**
SEm ±	3.45	3.72	1.54
CD(0.05)	9.84	10.62	4.409

*Significant at 0.05 % **Significant at 0.01 % and 0.05 %

Table 2: Performance of banana genotypes in respect of shelf life

Treatments	Green to yellow stage (Days)		
	Green life (Days)	Yellow life (Days)	Shelf life (Days)
T_1–Karibale (AAA)	10.67	4.33	15.00
T_2 - Kayipalle bale (ABB)	8.33	4.33	12.67
T_3 –Rajapuri (AAB)	6.67	4.33	11.00
T_4 - Red banana(AAA)	10.0	5.00	15.00
T_5 – Rasabale(AAB)	8.00	4.33	12.33
T_6 – Elakkibale(AB)	6.33	4.33	11.33
T_7–Kanayibanasi	10.00	4.33	14.33
T_8–Mitli (AB)	5.67	3.33	9.00
T_9–Bargibale (AAB)	9.67	4.33	14.00
T_{10} – Balbisiana (BB)	15.67	6.67	22.33
T_{11}–Pisanglilin(AA)	7.67	4.67	12.33
T_{12} -FHIA 3 (AABB)	9.33	5.67	15.00
T_{13} –Lalchakrakeli (AAA)	9.67	5.33	15.00
T_{14} -Basrai Dwarf (AAA)	8.67	4.33	13.00
T_{15} –Monthon (ABB)	11.33	6.00	17.33
T_{16} –Robusta (AAA)	7.67	4.67	12.33
T_{17} -Kadali (AA)	9.33	4.67	14.00
T_{18} -Yangavi KM -5 (AAA)	11.00	5.67	16.67
T_{19} - Sakkarebale (AB)	6.67	4.00	11.33
T_{20}–Karpuravalli (AAB)	8.67	5.00	13.67
T_{21} - Poovan (AAB)	14.33	6.67	20.67
T_{22}– Pisangawak (ABB)	9.00	4.67	13.67
T_{23} - Hanuman (AAA)	10.00	4.33	14.33
F- test	**	**	**
SEm ±	0.46	0.35	0.53
CD(0.05)	1.35	1.02	1.51

*Significant at 0.05 % **Significant at 0.01 % and 0.05 %

Green life (Days)

The data pertaining to the green life of banana genotypes and the data is presented in the table 2. The longest green life was noticed in the genotype Balbisiana (15.66 days) which was on par with the genotype Poovan (14.33 days). This might be due to slow chlorophyll degradation and slow conversion of starch into sugars which leads to enhance the green life and it purely belongs to Balbisiana (BB) group. Similar findings were obtained by Shaun *et al*. (1999) [9]. The shortest green life was noticed in Mitli (5.67 days).

Yellow life (Days)

The longest yellow life (6.67days) was observed in the genotype Poovan. The shortest yellow life (3.33 days) was noticed in Mitli. However, genotypes Balbisiana (6.67 days), Monthon (6.00 days), YangaviKM-5 (5.67 days), and FHIA-3 (5.67 days) were on par with the genotype Poovan (6.67 days). This might be due to presence of less soluble solids and its genetical charaters.

Shelf life (Days)

Shelf life differed significantly among the genotypes and the data is presented in the Table 2. Genotype Balbisiana recorded the longest shelf life (22.33 days) among all the genotypes, followed by Poovan (20.66 days). This might be due to presence of more starch and less soluble solids, green life, yellow life contributes to increase the shelf life. It belongs to Balbisiana (BB) group, pulp content is very less in the fruit and it is filled with seeds which indirectly helps in increasing the shelf of the fruit and delay the senescence. Similar findings were obtained by Adeniji *et al*. (2008) [1] and Shaun *et al*. (1999) [9]. Whereas, the shortest shelf life (9.00 days) was noticed in Mitli.

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