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Evaluation of Ginger (Zingiber officinale Rosc.) varieties under shade net

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ABSTRACT:
The experiment was conducted to know the performance of different ginger (ZingiberofficinaleRosc.) varieties under shade net condition. Eleven varieties of ginger were evaluated in RBD with three replications during kharif season of 2018-19 at College of Agriculture, Raichur, Karnataka, India. The growth parameters of eleven varieties indicated significant variation at all the stages of crop growth under shade net condition. Among the vegetative characters studied, the growth parameters like plant height (85.08 cm),number of tillers per plant (22.43), plant girth (4.00 cm) and leaf area index (10.50) were found to be significantly maximum in the variety Basavakalyan-1 at the final stage of observation (150 days after transplanting). The variety Basavakalyan-1 recorded the highest fresh rhizome yield per hectare (13.54 t ha^{-1}) followed by Maran (8.39 t ha^{-1}), Humnabad local (7.83 t ha^{-1}) and Mahim-2 (7.82 t ha^{-1}). It might be concluded that the ginger varieties Basavakalyan-1, Maran, Humnabad local, Mahima-2 showed better performance with respect to growth and yield parameters and these were found to be suitable for cultivation under shade net condition inN-E Karnataka.

I. INTRODUCTION:

Ginger is one of the most important and ancient spice crops in India, belongs to the family Zingiberaceae under the natural order Scitamineae. It is a tropical plant, believed to have originated in South East Asia probably India or China (Bailey, 1949). Ginger is an herbaceous perennial and rhizomatous spice crop containing volatile oil, fixed oil, pungent compounds, resins, starch, protein and minerals. Among the several components, 'alpha zingiberene' is the predominating component of essential oil. 'Gingerol' and 'Shagoal' are responsible for the characteristic pungency of the ginger rhizome. The refreshing aroma and the pungent taste make ginger an essential ingredient of food. Ginger powder is also an essential ingredient in varieties of masala or spice mixes. Ginger is used in several food articles viz., bread, biscuit, cake, pudding, soup and pickle. According to the Indian system of medicine i.e., Ayurveda, ginger rhizome is carminative and digestive. It is believed to be useful in treating dropsy, asthma, cough, diarrhoea, flatulence, nausea and vomiting.

India is the largest producer in the world and it plays an important role in earning foreign exchange for the country. In India, it is mainly grown in Assam, West Bengal, Maharashtra, Karnataka, Gujarat, Meghalaya, Andhra Pradesh and Tamil Nadu. Among these, Assam stands first with an area of 18,700 hectare and production of 1,66,500 metric tonnes. Karnataka occupies fourth place in the area (29.3 thousand ha.) and production (109.3 MT). Gujarat ranks first in the productivity (15,460 MT) (Anon., 2017).

The cultivation of ginger at present in N-E Karnataka region is not popular. As the crop is highly sensitive for high temperature in the region is being the reason for poor performance preferably in the Raichur, Gulbarga, Bellary, Koppal and Yadgiri districts. However, ginger is being cultivated in Bidar district in comparatively more area. Keeping these points in view, an alternative means of production of ginger by cultivating it under shade net conditions using different varieties was under taken.

II. MATERIALS AND METHODS:

The study included eleven varieties of ginger viz., Rio-de-Janerio, IISR Mahima, Mahim 1, Mahim 2, Himachal, IISR Varada, Basavakalyan -1, Humnabad Local, Maran, Sirsi Local, IISR Rajetha. The experimental site was located at Main Agriculture Research Station, Division of

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Horticulture, College of Agriculture, University of Agricultural Sciences, Raichur, Karnataka,India. The experiment was laid out in a Randomized Block Design with 3 replications. The soil was red sandy loam with good drainage and moderate water holding capacity. Before planting the experimental field was brought into fine tilth and planting was done during last week of May. The recommended POP were followed(Anon., 2014). Randomly ten plants from each treatments were selected to record the observations such as growth and yield parameters,like plant height, number of leaves, number of tillers, plant girth, weight of primary and secondary rhizomesand the data was analysed by adopting the statistical procedure as suggested by Panse and Sukhatme (1985).

III. RESULTS AND DISCUSSION

Growth characters

There was a significant variation in plant height, number of leaves per plant, number of tillers, plant girth and leaf area index among eleven ginger varieties used for the study(Table 1). The cultivar Basavakalyan-1 had exhibited maximum plant height of 85.08 cm followed by Maran(79.03) and Humnabad local (74.34 cm). However, Sirsi local was found to be with shorter stature of 61.48 cm. The variation in plant height might be due to genotypic responseof the varieties which were influenced by controlled climate under shade net condition (Surendraet al. 2012).

The variety Maran was found to have significantly higher number of leaves (214.43), whereas the genotype Sirsi local produced the least number of leaves per plant (99.83). This might be due to genotypic response of the varieties and their vegetative potential. It appears that relatively low temperature combined with low light intensity contributes to development of more chlorophyll in ginger plants grown in shade leading to higher number of leaves (Vastradet al. 2006). Leaves are the primary centres for the production of photosynthates and number of leaves produced by plants shows direct significant contribution for better plant growth and yield (Sharatet al., 2017).

The genotypes Basavakalyan-1 and Maran exhibited significantly higher number of tillers per clump (22.45 and 19.3 tillers per clump respectively). However, Sirsi local was found to be with significantly lower number of tillers (11.45 tillers per clump). This variation might be due to genotypic response of the varieties and availability of nutrients in the soil as this could have been influenced by low light intensity and high relative humidity under shade net condition (Rajalakshmi and Umajyothi, 2014). The other reason that could be attributed is the ability of a particular genotype to translocate higher quantity of stored food in the rhizome to the new sprouts along with favourable climatic conditions during the growth period (Balakumbahan and Joshua, 2017).

The genotype Basavakalyan-1 expressed statistically higher plant girth of 4.00 cm. The genotype Mahim-2 had significantly lower plant girth of 3.04 cm. Plant girth being an important growth parameter,the genotypes expressing the thicker stem would be stout and hardy with bold rhizomes. The genotype Basavakalyan-1 which had stronger and thicker stems might have influenced the higher rhizome yield. Thicker stem posses bold leaves and this might also have influenced more biosynthesis. The observations of present study are in accordance with the work of Ravi et al. (2016).

The genotype Basavakalyan-1 exhibited significantly higher leaf area index (10.50). Sirsi local and IISR Rejatha genotypes had significantly lesser leaf area index. Sirsi local had 2.08 leaf area index. The increased leaf area index is due to more number of tillers and number of leaves per plant which covered the ground area. High humidity under low light intensity conditions under shade also contributed for higher leaf area index (Surendraet al., 2017).

Rhizome characters

Data on different rhizome characters viz., Number of primary rhizomes and secondary rhizomes, weight of primary and secondary rhizomes, rhizome yield per clump and hectare are presented in Table 2.

There was no significant difference among secondary rhizomes. However, higher number of secondary rhizomes per clump were observed by genotype Basavakalyan-1 (22.70) followed by Maran (21.37), Humnabad local (21.13) and Mahim 2 (21.13). Sirsi local exhibited comparatively least number of secondary rhizomes per clump (16.43). Majority of the genotypes were found to be on par except Sirsi local.Basavakalyan-1 with highest number of primary rhizomes per clump (7.90) was found to be superior for primary rhizomes per clump. IISR Varada had least number of primary rhizomes per clump (6.00).As the primary and secondary rhizomes are the integral part of rhizome clump, more the number of primary and secondary rhizomes more would be influence on the total rhizome yield per clump. In case of Basavakalyan-1 more number of primary and secondary rhizomes per clump might have influenced the fresh rhizome yield.

Basavakalyan-1 (171.48 g) and Maran (154.11 g) were significantly superior for the weight of

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primary rhizomes. Whereas Rejatha (80.46 g) and Sirsi local (79.78 g) were found to be significantly inferior for this character. Basavakalyan-1 and Maran were found to be on par with each other for the weight of primary rhizomes. Similarly significant difference was observed in secondary rhizomes per clump. Again the genotypes Basavakalyan-1 (107.49 g) and Maran (81.13 g) exhibited significantly higher weight of secondary rhizomes per clump. Sirsi local (32.81 g) and IISR Rejatha (39.85 g) emerged significantly inferior for the weight of secondary rhizomes per clump. The number of primary and secondary rhizomes per clump, the average weight of primary and secondary rhizomes per clump were found to influence the rhizome yield per clump.

Basavakalyan local and Maran emerged as the significantly superior genotypes for higher rhizome yield per hectare under shade net conditions. Basavakalyan-1 with 13.54 tonnes and Maran with 8.39 tonnes per hectare differed significantly. The genotype Humnabad local (7.83 t ha^{-1}) and Mahim-2 (7.82 t ha^{-1}) were found to yield more than the

Table.1 Genotypic response of different gingervarieties for growth parameters under shade net condition.

Treatments	Plant height (cm)	No. of leaves/plant	No. of tillers/plant	Plant girth (cm)	Leaf area index
Rio-de-Janerio	68.47	120.37	15.80	3.83	3.55
IISR Mahima	65.8	145.27	14.17	3.73	4.50
Mahim-1	68.43	161.23	14.15	3.27	5.55
Mahim-2	75.7	113.47	15.86	3.04	3.88
Himachal	64.23	116.13	14.12	3.43	3.42
IISR Varada	73.66	120.00	13.35	3.28	3.17
Basavakalyan-1	85.08	282.67	22.45	4.00	10.50
Humnabad local	74.34	186.93	16.60	3.45	6.34
Maran	79.03	214.43	19.37	3.52	7.26
Sirsi local	61.48	99.83	11.45	3.23	2.08
IISR Rejatha	63.78	104.40	12.61	3.25	2.71
Mean	**70.91**	**151.34**	**15.45**	**3.46**	**4.82**
S.Em ±	**4.95**	**13.16**	**0.96**	**0.14**	**0.52**
C.D. at 5 %	**NS**	**38.81**	**2.83**	**0.42**	**1.54**

Table.2 Genotypic response of different ginger varieties for fresh rhizome yieldunder shade net condition.

Treatments	No. of primary rhizomes	No. of secondary rhizomes	Weight of primary rhizomes (g)	Weight of secondary rhizomes (g)	Rhizome yield per clump (kg)	Rhizome yield per ha (t)
Rio-de-Janerio	6.93	19.23	108.15	79.13	187.29	4.98
IISR Mahima	6.80	20.70	86.96	52.16	139.13	4.73
Mahim-1	6.80	20.80	110.92	62.69	173.62	5.81
Mahim-2	7.07	21.13	109.02	63.96	172.99	7.82
Himachal	6.47	18.60	99.76	52.66	151.43	4.15
IISR Varada	6.00	20.40	84.67	39.52	124.20	4.62
Basavakalyan-1	7.90	22.70	171.48	107.49	278.99	13.54
Humnabad local	7.23	21.13	118.71	66.75	205.47	7.83

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Maran	7.33	21.37	154.11	81.13	235.26	8.39
Sirsi local	6.23	16.43	79.78	32.81	112.60	1.77
IISR Rejatha	6.27	18.20	80.46	39.85	120.32	3.12
Mean	**6.82**	**20.06**	**109.46**	**61.65**	**172.85**	**6.07**
S.Em ±	**0.51**	**1.26**	**9.46**	**4.01**	**12.40**	**0.64**
C.D. at 5 %	**NS**	**NS**	**27.90**	**11.82**	**36.58**	**1.88**

Average value of all other genotypes (6.07 t ha^{-1}). Himachal (4.15 t ha^{-1}), Rejatha (3.12 t ha^{-1}) and Sirsi local (1.77 t ha^{-1}) were found to be low yielders under shade net conditions. The remaining genotypes such as Rio-de-Janerio, IISR Mahima, Mahim 1, Mahim 2 and IISR Varada were found to be moderately yielding genotypes under shade net. The superiority of the Basavakalyan-1 might be attributed to its significantly higher rhizome yield per lump (278.99 g). Similarly the Maran and Humnabad local also expressed statistically higher values (235.26 g $clump^{-1}$ and 205.47 g $clump^{-1}$) respectively, which might have influenced the rhizome yield per hectare. The difference in yield might be due to the variation in number of tillers produced per plant, which is genetically controlled character. The low temperature with low light intensity under shade net might also have contributed to the development of more chlorophyll, optimum biomass and increased crop growth which has resulted in the highest fresh rhizome yield per plant (Surendraet al., 2017). This might also be due to variation in the eco conditions and the cultural practices adopted in that region (Balakumbahan and Joshua, 2017).

IV. CONCLUSION:

Among the eleven different genotypes evaluated, the genotype Basavakalyan-1 performed better with respect growth and yield parameters followed by Maran and Humnabad local. Hence, they could be suitable varieties for commercial cultivation in N-E Karnataka under shade net condition.

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