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Evaluation of single node cutting and transplanting technology in ginger

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Abstract

Ginger (*Zingiber officinale* Rosc.) belongs to the family Zingiberaceae, has been prized for its aroma flavour, pungency and medicinal properties since ancient times. Seed rhizome size, planting method are the important aspects of production systems of ginger. A transplanting technique in ginger by using bud sprouts raised in pro-trays was standardized by Indian Institute of Spice Research, Kozhikode (IISR, 2014). Though transplanting in ginger is not conventional, it was hypothesised as it saves two hand weeding and assist in quick crop establishment. It saves nearly 60% of seed rhizome cost. An experiment was undertaken with the objective to compare transplant and direct plant systems on yield and economics of ginger. Experiment was conducted at ICRI Spices Board Sakleshpur for two consecutive years (2022-2024). The experimental had of four treatments laid out in a randomised block design (RBD) with five replications. In T1, ginger rhizomes were cut into 5-7g with a single sprout in each piece, raised in pro-trays and transplanted. T2, slightly bigger rhizome bits of 8-10g with two sprouts, raised in pro-trays were transplanted. The rhizomes of 25-30 g size with two sprouts were directly used for planting in T3 and 20-25g of rhizomes without visible sprout was used for direct planting in T4. In the first two treatments, seedlings were raised using 50 cell pro-trays, using partially decomposed coir pith and vermicompost (3:1) enriched with *Trichoderma* as a nursery medium Ginger variety Himachala was used in the study. Maximum plant height and number of tillers were significantly higher in T_3 at both the stages (90 and 150 DAS). The maximum (15.51 tonnes/ha) pooled mean was recorded by direct planting of sprouted rhizomes (T3) followed by direct planting of non-sprouted ginger rhizome, T_4 (15.01 tonnes/ha). Among the four planting systems compared, direct planting of sprouted rhizome was advantageous by considering the yield and profit advantage. Highest net return and B:C ratio (Rs. 346420 and 2.14) was recorded in treatment where sprouted/non sprouted rhizomes of 25-30 g were directly planted as compared to, trans planting oh ginger seedlings raised in pro-tray. Even though in transplanting method reduced seed rhizome quantity eventually reduced cost on seed rhizomes it failed to give higher yield level as compared to conventional planting. On the contrary there is an added advantage of reduced two hand weeding in comparison to conventional direct rhizome planting. On the contrary, if we compare the cost involved and number of labour units consumed for transplanting and direct planting five labour is required for direct planting of rhizomes but nine labour units were required for transplanting. Similarly, labours involved in raising seedling for 40 days itself will consume 12 labours. Ginger can be successfully grown for higher fresh rhizome yield by conventional method of planting either sprouted or non-sprouted rhizome as compared to transplant system using single/two sprout with comparable yield and operational convenience. However, the transplant system benefitted significantly from reduced seed rhizome quantity. This would eventually reduce the cost incurred on seeds but not on net return. Hence transplanting technique may ideally suit for multiplication of rhizomes quickly under a situation where shortage of seed rhizome is critical.

Keywords: Ginger, transplanting, rhizome, B C ratio, fresh rhizome yield.

Introduction

Ginger (*Zingiber officinale* Rosc.) belongs to the family Zingiberaceae, has been prized for its aroma flavour, pungency and medicinal properties since ancient times. Commonly used as a spice for over 2000 years and contains characteristic odour and flavour such as the pungent taste. Development of suitable production technology to boost the crop yield is essential as the yield potential of the variety alone is not sufficient for increasing the yield (Yadav *et al.*, 2014) [9]. Seed rhizome size, plant spacing are the important aspects of production systems of ginger. It is well documented that rhizome sizes and plant spacing have significant influences on the growth and yield of ginger (Monnaf *et al.*, 2010) [6]. In ginger, planting material requirement is very high and it involves 40 per cent of its cost of the total cost of cultivation. Whole or split rhizomes with healthy buds is used for planting. A transplanting technique in ginger by using bud sprouts raised in pro-trays was standardised by Indian Institute of Spice Research, Kozhikode (IISR, 2014). Though transplanting in ginger is not conventional, it was hypothesised as it saves two hand weeding and assist in quick crop establishment. It saves nearly 60% of seed rhizome cost. A transplanting technique in ginger by using single bud sprouts (about 5g) has been standardized to produce good quality planting material with reduced cost. The technique involves raising transplants from single sprout seed rhizomes in the pro-tray and planted in the field after 30-40 days. The advantages of this technology are production of healthy planting materials and reduction in seed rhizome quantity and eventually reduced cost on seeds. Hence the present study was undertaken with the objective to compare transplant and direct plant systems on yield and economics of ginger.

Material and Methods

An observational field trial was conducted at Spices Board, Indian Cardamom Research Institutes' Regional Research Station Sakleshpur Karnataka, India. The study reported here was initiated in March 2022 and was repeated for a period of two seasons (2022-2023. 2023-2024). The area falls under hilly zone, agroclimatic zone of Karnataka. The experiment was conducted under irrigated condition. The soil of experimental plot was sandy loam in texture, pH 5.9 organic carbon content 1.3%, phosphorus 18 kg/ha, potassium 338 kg/ha. The experimental materials consisted of four treatments of different planting systems, laid out in a randomised block design (RBD) with five replications. In T1, ginger rhizomes were cut into 5-7g with a single sprout in each piece, raised in pro-trays and transplanted. T2, slightly bigger rhizome bits of 8-10g with two sprouts, raised in pro-trays were transplanted. The rhizomes of 25-30g size with two sprouts were directly used for planting in T3 and 20-25g of rhizomes without visible sprout was used for direct planting in T4. In the first two treatments, seedlings were raised using 50 cell pro-trays, using partially decomposed coir pith and vermicompost (3:1) enriched with *Trichoderma* as a nursery medium (Prasath *et al*. 2014) [7] and 35 to 40 day old seedlings were transplanted on raised beds of size 3 × 1 × 0.30 m (l × b × h). During planting, shallow pits of 5-10 cm depth were made at a spacing of 25 × 25 cm in the beds and the seed rhizomes or transplants was placed 3.5-5.0 cm deep in these pits. The pits with rhizome were then covered with soil and transplants were planted. All the treatments were field planted in second fortnight of March and harvested during mid-November. Ginger variety Himachala known for its high yield was used in the study. Dry leaf mulch was applied @ 12 t/ha after planting, to all the beds, irrespective of the treatments. The mulching is practiced to prevent soil erosion and exposure of ginger rhizomes to heavy rainfall. The biometric observations were recorded at various stages of crop growth. The plot (3 × 1 m) yield was recorded at harvest and projected to tonnes/ha. Collected data was subjected for statistical interpretation as per the procedure (Gomez & Gomez 1984) [4].

Table 1: Effect of ginger planting systems on growth characters (pooled data of two years)

Treatment	Plant height (cm)		Number of tillers/clumps		Days for physiological maturity	Fresh rhizome yield kg/clump	Fresh rhizome yield (tonnes/ha)
	90 DAP	150 DAP	90 DAP	150 DAP			
T1: Transplanting 5-8g weighing single sprout seedling	42.8	68.6	8.6	12.8	175	152.6	11.45
T2: Transplanting 8-10g weighing two sprout seedlings	45.2	69.0	10.8	15.4	168	157.1	11.78
T3: Direct planting 25-30g weighing sprouted rhizome	51.6	82.4	12.4	18.2	172	206.8	15.51
T4: Direct planting 25-30g weighing non sprouted rhizome	38.0	78.0	10.6	16.8	192	200.2	15.01
S.Em (±)	1.24	0.97	0.68	1.12	-	3.32	0.68
CD @5%	3.72	2.91	2.1	3.4	-	10.12	2.04

Results and discussion

The plant height among the treatments varied significantly and maximum plant height at was recorded in T_3 at both the stages (90 and 150 DAS) where sprouted ginger rhizomes of 25-30g was direct planted as compared to other treatments (Table 1). Maximum number of tillers per plant (18.2) was recorded by the planting of 25-30 g rhizomes (T3) closely followed by T_4 (16.8). This variation in plant growth parameters is due to easy establishment of plants and its early growth observed in treatment where sprouted ginger rhizomes of 25-30g was directly planted. Similar findings in different potato planting systems were earlier reported by Wiersema and Cabello (1986) and Batra *et al*. (1992) [1]. Even though transplanting technique has helped for quicker plant establishment in early stages but in the later part of the plant growth stages transplanted seedlings growth was side lined by treatments where direct planting of higher size of rhizomes was done. Consistent supply of food from the larger sized rhizomes on comparison to small sized rhizomes helped in better growth as well as quicker biomass accumulation. This has helped in realising higher number of tillers per clump in treatments where sprouted ginger rhizomes of 25-30g was direct planted. This physiological betterment has helped in attaining higher fresh rhizome yield per plant as well as on hectare basis also. Fresh Rhizome yield was recorded for two years and pooled mean yield presented in table.1. The analysis of variance showed significant differences for fresh rhizome yield among the treatments during both the years (Table 1). The maximum (15.51 tonnes/ha) pooled mean was recorded by direct planting of sprouted rhizomes (T3) followed by direct planting of non-sprouted ginger rhizome, T_4 (15.01 tonnes/ha). Smith and Hamil (1996) [8] reported reduced rhizome yield in micropropagated first generation ginger plantlets as compared to that of normal seed rhizomes. In Ethiopia, Girma and Kindie (2008) [3] reported that the rhizome size of 32 g recorded maximum yield (55-124%) compared to 4 g seed rhizomes. Whereas, in the present study also in agreement with the earlier findings as mentioned above. Higher growth and yield attributes observed in the current study for the recommended sized rhizome planting was due to the cumulative effect of better growth in in field. In case of planting sprouted rhizome, early establishment and bulking of rhizomes of ginger might be the reason for higher yield. Bhagyalakshmi and Singh (1988) [2] reported that vegetative bud regenerated plants were at par with the conventionally propagated ones except that they need longer (additional 2 months) crop duration for the same effect.

Table 2: Economics of ginger under different planting systems

Treatment	Seedling/ rhizome cost /ha (Rs)	Cost of production (Rs)	Fresh rhizome yield tonnes/ha	Gross Returns (Rs)	Net Returns (Rs)	BC ratio
T1: Transplanting 5-8g weighing single sprout seedling	64000/ seedlings for one ha	2,60,000	11.45	480900	220900	1.85
T2: Transplanting 8-10g weighing two sprout seedlings	88000/ seedlings for one ha	2,80,000	11.78	494760	214760	1.77
T3: Direct planting 25-30g weighing sprouted rhizome	Rs. 1,00,000/-	3,05,000	15.51	651420	346420	2.14
T4: Direct planting 25-30g weighing non sprouted rhizome	Rs. 1,00,000/-	3,05,000	15.01	630420	325420	2.07

Cost of seed rhizome Rs 50/kg
Selling price of fresh rhizome Rs 2100/ 50kg bag or Rs 42.00/kg

Among the four planting systems compared, direct planting of sprouted rhizome was advantageous by considering the yield and profit advantage. Highest net return and B:C ratio (Rs. 346420 and 2.14) was recorded in treatment where sprouted/non sprouted rhizomes of 25-30 g were directly planted as compared to transplanting of ginger seedlings raised in pro-tray. Even though in transplanting method reduced seed rhizome quantity eventually reduced cost on seed rhizomes (Table 2) it failed to give higher yield level as compared to conventional planting. On the contrary there is an added advantage of reduced two hand weeding in comparison to conventional direct rhizome planting. On the contrary, if we compare the cost involved and number of labour units consumed for transplanting and direct planting five labour is required for direct planting of rhizomes but nine labour units were required for transplanting. Similarly, labours involved in raising seedling for 40 days it self will consume 12 labours.

Summarizing the results obtained in the present study, we may conclude that ginger can be successfully grown with higher fresh rhizome yield by conventional method of planting either sprouted or non-sprouted rhizome as compared to transplant system using single/two sprout with comparable yield and operational convenience. However, the transplant system benefitted significantly from reduced seed rhizome quantity. This would eventually reduce the cost incurred on seeds but not on net return. Hence transplanting technique may ideally suit for multiplication of rhizomes quickly under a situation where shortage of seed rhizome is critical.

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