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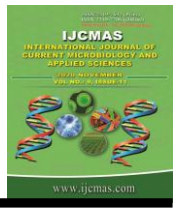

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Largest Individual Ginger (*Zingiber officinale* Roscoe) Cluster Produced in Jute Fabrics Reinforced Soil Columns

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A B S T R A C T

Ginger (*Zingiber officinale* Roscoe) was grown as intercrop in summer rice field followed by its sole cropping, in jute fabric based soil columns to provide better drainage and aeration to the crop at ICAR-CRIJAF research farm in 2013-14. The individual initial planting rhizome (seed) weight varied from 80-100 g each. The crop was grown with a fixed nutrition and pesticide schedule. Healthy individual ginger bushes produced as high as 139 tillers. The maximum approximate radii of ginger clusters and its depth varied from 33-45 cm and 10-16 cm, respectively (Fig. 1). The cluster contained large number of individual small rhizomes in compact masses all connected together. Largest ginger individual cluster, maximum up to 4.5 kg were developed on jute fabrics based soil columns in 9 months. Careful excise in ginger farming adopting this technology will substantially increase farmers' income. This system will also help the resource poor farmers to meet their own requirements for home scale consumption.

Introduction

Ginger (*Zingiber officinale* Roscoe) is a widely used herb and food flavouring agent. Its nutraceutical properties have been of interest to the food processing and pharmaceutical industries since long. It is normally sold in the form of shade dry fresh rhizomes (6-9 month old) or in preserved packets by different commercial vendors. It is normally cultivated on ridges to provide adequate drainage, as it cannot withstand waterlogging. Of late, in India, the crop loss is severe due to fungal and bacterial attack which results in rotting of rhizomes. In the northeastern hills of India, rhizome rot is incited by *Pythium aphanidermatum*, a highly destructive disease. Incidence of soft rot disease varied from 7.23 to 40.26% and 5.23 to 34.84% in 2012 and 2013, respectively (Singh *et al.*, 2018). To combat the situation, ginger rhizomes were planted on jute

reinforced soil columns which provides adequate drainage through lateral and vertical drainage in short time, maintains proper moisture regime and improves oxygen diffusion rate in the columns over conventional ridge planting (Ghorai *et al.*, 2013, 2014 and 2020) system.

Materials and Methods

Jute fabrics based soil columns (45 cm height and 30 cm radius, Fig. 2) were made in summer rice field in 2013-14 (45 days after rice transplantation, on 1st week of April 2014) to minimise irrigation requirements of early planting ginger which is very costly at present. The hydrograph of ponding varied from 0-10 cm during rice growth period. The soil was sandy clay loam in texture, having 44 per cent sand, 28 per cent silt and 28 per cent clay. The soil contained 195, 51 and 124 kg available nitrogen, phosphorus and potassium /ha respectively. The pH of the soil is neutral. The ginger rhizomes (80-100 g each) were planted on soil columns, mulched with straw and watered for germination. After the rice harvest (Fig. 3 and 4), the columns were strengthened with soil and jute hessians, fertilized with 150 g, N:P:K::10:26:26, 50 g urea, 500 g rice straw ash, 100 g neem cake and 100 g bone meal. The top radius was made upto 60 cm for lateral spread of rhizomes (Fig. 4). Excess water from field was drained out and the crop was treated with different fungicides (Bavistin, Blitox and Hexaconalzole) and bacteriocides (Streptocycline) to prevent rhizome rot. Some of the columns were fenced with rice straw to prevent damage of columns. To prevent termite attack systemic insecticides were sprayed. The crop was harvested at 9 month old stage (10/1/2014) and the rhizome clusters were properly washed. Fresh matured old ginger rhizomes contained 94.17 ± 0.16 % moisture when harvested at 10 to 12 months old stage (Puengphian and Sirichote, 2008).

Results and Discussion

The hessian based soil columns maintained proper moisture regime (13.0 to 23.5 per cent) in it and improved oxygen diffusion rate (280 $\mu gO_2/m^2/sec$, ODR Meter, Eijkelkamp, The Netherlands) in the columns over conventional ridge planting (Ghorai *et al.*, 2013) system. We did not record any rhizome rot in this system. The individual ginger tillers had 16 to 21 leaves and attained a height of 51-70 cm. The rhizome weights were taken after thorough wash and sun drying for 5-6 hours. The detailed biometry of the crop is given in Table 1. The cluster contained many small individual rhizomes/fingers (difficult to count as the clusters are compact masses).

Table.1 Biometry of ginger crop in jute reinforced soil columns

Sl.No.	Plant /tiller height (cm)	Leaves /tiller (Nos.)	Tillers/ column/clump) (Nos.)	Individual cluster radius (approx.). cm	Individual cluster depth (approx.) cm	Individual rhizome cluster weight (kg)
1	55 cm	15.6	139	36	16	4.50 Kg
2.	53 cm	19.00	123	35	15	4.50 kg
3.	59.2 cm	17.60	103	39	16	4.50 kg
4.	51.0 cm	19.20	84	45	15	4.50 kg
5.	70 cm	20.60	124	33	10	4.50 Kg
6.	54.2 cm	19.60	74	39	14	3.80 kg
7.	59.6 cm	16.20	89	45	16	3.80 kg
8.	60.4 cm	20.8	55	40	15	3.30 kg
SD (±)	5.98	1.93	28.56	4.49	2.07	0.49

Fig.1 Surface and ventral view of a largest ginger cluster: Its sundry weight is 4.50kg, approximate radius is 39 cm and its depth/thickness is 16 cm.

Fig 2 Jute fabrics reinforced soil columns developed in waterlogged rice field

Fig.3 Soil columns with young gingers being freed from rice crop, after its harvest

Fig.4 Earthingup, manuring and column repair of ginger after rice harvest. Few columns were tied with straw for firmness after hessian decay)

The approximate cluster radius/spread varied from (due to irregular size**)** varied from 33-45 cm and the depth of the rhizome cluster varied from 10-16 cm. The maximum weight of each rhizome was 4.5 kg (Sl. No 1 to 5). The respective columns/clumps contained 84-139 tillers (Fig. 4). We got high degree of positive correlation between tiller numbers of ginger and its rhizome weight (Eqn. 1). The cost of production was for each column was Rs.70 only and the return from each column was Rs.560.

$$Y = 2.632 + 0.016\ X,\ r = 0.828,\ R^2 = 0.70 \quad (1)$$

Where Y is the weight of rhizome clusters (kg) and X is the number of tillers/column.

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