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Promising tomato hybrid Pusa Rakshit (DTPH-60) for cultivation under protected conditions

Development of tomato hybrids/lines for protected condition will not only increase the productivity and quality of tomato but also make available the hybrid seeds at cheaper rate to the farmers'. At present the seed cost of private sector companies is very high and seed is sold on count basis. The newly developed tomato hybrid Pusa Rakshit (DTPH-60) thick pericarp, attractive round shape, red colour fruits and high yielding ability.

INDIA is the second largest vegetable producer in the world next to China with total production of 180 million tonnes from an area of 10.4 million hectares with productivity level of 17.3 t/ha. Though the vegetable sector is growing very fast, still we have to go a long way to meet the rising demand of ever increasing population. To achieve this target, we have to increase our vegetable productivity by incorporation of newly developed hybrids and high yielding varieties as well as adoption of various technologies, like protected cultivation, drip and sprinkler irrigation, off-season vegetable production, container and terrace gardening etc. Many times farmers produce good amount of cucumber, capsicum and tomatoes during main season, which eventually leads to the market glut and fall in price. On the other hand, due to extreme weather conditions, it is difficult to grow high value vegetables like tomato, capsicum, cucumber etc. in open field condition especially during rainy and winter season. Therefore, polyhouse technology has been found very effective for off-season production as well as round the year production of these high value vegetables. For cultivation under protected condition, the varieties as well as cultivation practices are different from the open field condition. As present vegetables, like cucumber, tomato and capsicum are most popular and commercially grown vegetables for protected condition. As we know that tomato is third important vegetable in India after potato and onion from production point of view, which evident from its total production of 19.4 million tonnes and productivity level of 24.7t/ha at all India level. Moreover, at present no hybrid of tomato is available with public sector for protected condition and the private sectors are selling hybrid seeds at very high cost.

Keeping above in view, Division of Vegetable Science, ICAR-IARI have developed tomato hybrids Pusa Rakshit which has been identified for release for NCT of Delhi to provide farmers seeds of hybrids at reasonable prices and ensure production of high value vegetables having quality fruits round the year. The performance of hybrid with recommended cultural practices are given in this article to raise a good crop.

Major advantage of growing vegetables under protected environment

- High yield under protected structure due to utilization of vertical space and enhanced crop duration.
- Off-season and round the year production is possible without much effect of external environment depending upon type of structure.
- Cultivation is possible under different conditions, like

Fruits of new tomato hybrid Pusa Rakshit (DTPH-60)

Fruits of tomato Cherry Selection-2

hilly area, dessert and even under snow dessert in different location specific structure.

- Efficient use of resources, like water, fertilizers, sunlight etc.
- Produce with high quality due optimum environmental condition throughout the growing period and less effect abiotic and biotic stresses.

Salient features of promising tomato hybrid Pusa Rakshit (DTPH-60)

- It is a hybrid variety of tomato suitable for cultivation under protected condition.
- Fruits are round, deep red in colour with average fruit weight of 108 g.
- The ripe red fruits have TSS 5.2 of ^{O}Brix and lycopene content 6.0 mg/100 g.
- It gives an average yield of 8 kg/plant in 7-8 months crop duration.
- The average yield potential is 15 quintals from 100 square meter area of polyhouse.

Performance of new tomato lines in station trial

28 F_1 cross combinations of tomato (*Solanum lycopersicum* L.) were evaluated under protected condition. Hybrid DTPH-60 recorded maximum total yield of 15.6 q from 100 sq. m. area, 5.2°Brix TSS and 5.8 mg/100 g lycopene with average fruit weight of 108g. Hybrid DTPH-60 was found at par to GS-600 in yield and other traits (Table1).

Package of practices for crop production of tomato Hybrid Pusa Rakshit (DTPH-60)

Climate

It requires relatively warm season for its growth and development. It is highly susceptible to frost. Environmental factors such as temperature, light intensity and humidity effect fruit set, fruit development, yield and quality. Fruit set is poor when temperature is either relatively low (less than 16^{0}C) or high (more than 35^{0}C). The ideal night and day temperature for fruit set and colour development is 20^0 -25^{0}C.

Sowing time

In North Indian plains, under fully controlled environment it can be planted from August and crop may last up to May, while under low cost polyhouse/naturally ventilated structure, transplanting is done in September end and crop may last up to April.

Soil

Well-drained sandy loam soil is ideal for growing good crop. It prefers a *p*H of 6-7.

Fig. 2: Tomato hybrid Pusa Rakshit (DTPH-60) under low cost polyhouse at Research Farm, Division of Vegetable Science, IARI, New Delhi

Seed rate

Seed rate is 125 g/ha.

Nursery raising

Nursery should be raised either in polyhouse or insect proof net house. It should be raised in soilless media (cocopeat, perlite and vermiculite mixture) to produce disease free and healthy seedlings. The seedlings should be raised in portrays. Fine and sieved combination of cocopeat: vermiculite: perlite in ratio of 3:1:1 by volume should be used as growing media. The filled protrays should be kept inside poly house/insect proof net house. One seed should be sown in each holes of portrays. Seed should be sown in nursery 25 days before the due date of transplanting after treating them with thiram @ 3g/kg seed. Immediately after sowing the seed, light irrigation should be given by watering can containing captaf @ 2g/litre of water. After one week of sowing again new seeds should be sown where seed germination could not take place. In soilless media, nutrients are applied in the form of N: P: K (1:1:1) @ 140 ppm once a week through the fine sprinkler to maintain the uniformity in application of nutrients. After 22-25 days of sowing, when the seedlings became 10-12 cm long and four true leaves had emerged, it should be kept for 2-3 days for hardening by holding

Table 1. Mean performance of tomato hybrid line DTPH-60 at IARI, New Delhi during winter season from 2015 to 2017

Variety	Yield (q/100 sq. m. area)			Average yield (q/100 sq. m. area)	Aw. Fruit weight(g)	TSS (%)
	2015	2016	2017			
(DTPH-60)	14.4	16.5	15.8	**15.6**	**108**	5.2

Tomato Cherry Selection-2 under low cost poly house

irrigation for two days. Hardening of seedlings before transplanting is very effective in reducing transplanting shock and also resulted in better crop stand.

Transplanting

Transplanting should be done on both sides of 10 cm raised bed of 0.75 m width. There should be 30 cm distance between two beds. The seedlings should be transplanted at 0.60 m distance within row on both sides of the raised bed. It should be planted under drip irrigation system for efficient use of water and fertilizers.

Manure and fertilizers

Soil testing must be done to determine the soil fertility of protected environment and the deficiency of nutrients must be supplemented as and when required. In general, about 25-30 metric tonnes per hectare of well rotten farmyard manure should be added at the time of preparation of land. In addition, 80 kg phosphorus and 90 kg potash is added at the time of land preparation before transplanting. 150 kg of nitrogen is applied in split doses, one third at the time of transplanting and other two third in the form of four top dressings, first at 25-30 days after transplanting, second after 50-60 days after transplanting or flowering, third after first picking and fourth after second picking. Foliar spray of 1% urea is beneficial and it should be applied after every picking later on. Mixture of micronutrients (especially calcium and boron) should also be applied at the time of flowering @ 0.5% water solution.

Irrigation

It is necessary to maintain even moisture supply, as overwatering is harmful. Water is essential at the time of flowering and fruiting. Adequate moisture also helps in better colour development. Irrigation is applied at 8-10 days' interval in winter season whereas during summer months, irrigation is applied at 4 days' interval depending upon weather conditions. If possible drip facility should be installed for efficient irrigation and fertigation. Mulching with black polythene mulch helps in conservation of soil moisture and weed management.

Intercultural operations

Weeds are often a limiting factor in tomato production as they share light, water, nutrients and space, harbour insect pests and diseases. Frequent hoeing should be done as often as necessary to control weeds. Tomato bed before mulching and transplanting should be drenched with Stomp @ 2 ml/liter solution for controlling pre emergence weeds.

Training, pruning and trellising

Staking is an important operation for tomato under protected condition. Staking should be done 20-25 days after transplanting. The plants should be loosely tied on vertical stakes. The timely staked plants produce more and better quality fruits. All the side branches/shoots should be removed/pinched at early stage to maintain single stem. Plants are supported by plastic wire or blinder twine loosely anchored with plastic clip at base of plant to overhead support wires running to the length of row of bed. Overhead wires running over the row of the bed are fitted 8-10 feet above and firmly supported with structure. Stem/vine of the plant is either fitted in round plastic clip of one-inch diameter with hanging twine or twine is wrapped around stem below the leaves clockwise leaving top 15 cm shoot of the growing plant. Regular pruning of side shoots should be done for entire crop duration. After first harvest, the leaves touching the ground (up to one feet from ground) should be removed which improves air circulation and reduces disease incidence.

Pollination

Since tomato is a self- pollinated crop having bisexual flower, therefore normal flowering and fruiting takes place in sunny weather, however for better fruit setting in foggy or cloudy weather electric vibrators or air blowers or manual shaking can be used for effective pollination during 10 to 11 AM and 2 to 3 PM in the day.

Harvesting

Harvesting starts 70-75 days after transplanting. Harvesting depends upon purpose for which they are harvested and distance over which they are to be transported. Tomato is harvested at mature green stage for long distance transportation. For short distance transportation fruits are harvested at pink stage and for processing fully ripe red colour tomatoes should be harvested.

Average yield

Yield depends climatic factors and culture practices. On an average, normal tomato gives fruit yield around 15 q/100 sq. m. area of polyhouse and cherry tomato gives 10q/100 sq. m. area of poly house.

Plant protection

The warm, humid conditions and abundant food under protected conditions provide an excellent, stable environment for pest development. Sanitation, soil polarization, mulching and fumigation are done to manage pest in protected condition. Major pest of tomato under polyhouse are whiteflies and mites, which come inside with the workers due to frequent entry in the polyhouse. Nematode also a major problem in polyhouse. The polythene used as cladding material should have 200-micron thickness and UV stabilized. Similarly, insect proof net should be of 40 mesh. Building a screened foyer to create a double-door entry partially solve the problem of wind-carried insects. Our major emphasis should be on prevention of entry of pest inside the protected structure. The seedling should be raised in protected environment for transplanting. The lower or damaged leaves should be removed to make ground clear for proper ventilation and to avoid spread of pests. For whiteflies, aphids and leaf miner adults, yellow sticky cards (8"x12") should be place @5/100 sq. m. area for control of pest in the protected environment. Hang the yellow sticky cards/ traps in the crop with the help of strings about 4" to 6" above the plant canopy. As the crop grows, cards can be moved up. Change the cards when more than 60-70% of the area is covered by trapped insect. For effective management of pest and diseases, Integrated Pest Management (IPM) strategies to be followed. If required, apply dicofol @ 2 ml /litre water to control mites and trizophos @1 ml/3 lit water to control whitefly. For fungal diseases mixture of 1g carbendazim and 1g mancozeb @per litre water solution can be applied.

New tomato hybrid Pusa Rakshit (DTPH-60) under naturally ventilated polyhouse, Centre for Protected Cultivation Technology, ICAR–IARI, New Delhi

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