

Comparative Studies on Germination in Some of the Varieties of Tomato (*Lycopersicon esculentum* Mill.) Grown in Jharkhand State

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Abstract: Jharkhand is one of the states of India which is the major player in the production of vegetables in the country. Tomato is one of the vegetables which is produced largely in the state for livelihood by the farmers. Different varieties are available to the farmers in the market. The comparative germination studies of some of the varieties were done in order to determine the seedling vigour index which is an important feature for establishment of seedlings. Two pure line breed and six hybrid varieties were studied for their germination characteristics and compared. The germination percentage, Mean germination time and the seedling vigour index were found to be more in hybrid varieties as compared to the pure varieties.

Keywords: seed germination, seedling vigour index, mean germination time, tomato

1. Introduction

Vegetable production can be adopted as a strategy for improving livelihood and alleviating the nutritional status of the people. It is the answer to the perpetual problems of hunger and malnutrition in the country. Tomato (*Lycopersicon esculentum* Mill.) is one of the most important vegetable crops grown all over the world. It is the world's largest vegetable crop after potato and sweet potato but it tops the list of canned vegetables. Tomato is a good source of vitamins A, C and E and minerals that are very good for body and protect the body against diseases (Taylor, 1987). Tomato growing is considered a high risk activity due to the great variety of environments and systems in which it is grown, high susceptibility to pests and diseases, and high demand for inputs and services, which lead to high financial investment per unit area. Furthermore, Lopes et al. (2005) remark that good productivity requires availability of water throughout the cycle, as the tomato plant is very sensitive to water stress. The commercial value of the table tomato is defined by the characteristics and quality of the fruit (Ferreira et al., 2004). Tomatoes are planted by an estimated 85% of the gardens each year. If well managed, tomato is highly productive (Denton and Swarup, 1983). Germination of seed is an important point in seedling establishment and subsequent plant health and vigour.

Vegetables in Jharkhand are grown all over the state on an area of 293.53 thousand hectares with production of 3370 thousand MT during 2016-17. Jharkhand ranks 14th in vegetable production and 16th in tomato production. In India, 2.52 % of vegetables and 1.55 % of tomato are produced in Jharkhand. (Value Chain Study of Tomato Of Ranchi, Jharkhand 2017-18, NHRDF)

2. Materials and Methods

Experimental procedure and design

In the experiment tomato seeds of eight cultivars were disinfected with 70% ethanol for 60 seconds and 0.1% sodium hypochlorite solution for 30 seconds. 30 seeds were germinated on one layer of filter paper in 9 cm petri dishes. The Petri dishes were covered to prevent the loss of moisture by evaporation under laboratory condition ($25 \pm 1^\circ\text{C}$) for 7 days.

The tomato varieties used included six hybrid varieties and two pure line breed. The seeds of the five varieties were taken from the market – S-22, MSN-55, BSS908 Priya, ES2205 Param. And the rest three varieties taken from ICAR RCER, Palandu, Namkum were Swarna Baibhav, Swarna Lalima and Swarna Sampada. Out of these all are hybrid varieties except Swarna Lalima and Rita which are pure line breed.

Seedling growth parameters measurements

Seeds were considered germinated when they exhibited radicle extension of > 2 mm. Every 24 hours after soaking, germinated seeds were observed daily during the course of the experiment to determine following germination parameters. Where the number of germinated seeds was recorded 7 days after planting as Germination Percentage (GP) according to ISIA (1993) and ISIA (1999): $GP = (Ng / Nt) \times 100$, Ng = Total number of germinated seeds, Nt = Total number of seeds evaluated.

Mean Germination Time (MGT) or Mean Emergence Time (MET) was calculated according to Ellis and Roberts (1981): $MGT = \sum Dn / \sum n$, Where n is the number of seeds, which were emerged on day D, and D is the number of days counted from the beginning of emergence.

The seedling vigour index was calculated according to following formula (Abdul-Baki and Anderson, 1970):

$$SVI = (\text{seedling length (cm)} \times \text{germination percent}) / 100.$$

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The experiment was terminated by harvesting seedlings 7 days after seeds soaking and traits including plumule length, radicle length, plumule dry weight, radicle dry weight were

measured. Dry weight was determined after drying samples in oven at 70°C for 48 hours.

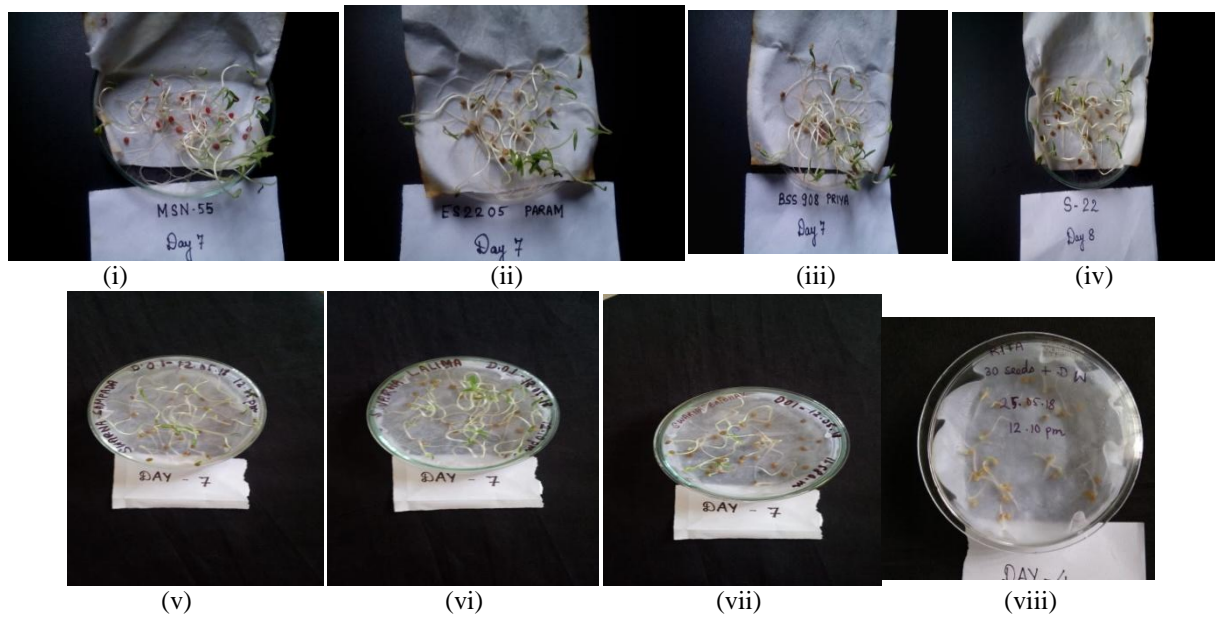


Figure 1: Germination of seeds of the eight varieties –(i) MSN-55, (ii) ES2205 PARAM, (iii)BSS908 PRIYA, (iv)S-22 (v)SWARNA SAMAPADA, (vi) SWARNA LALIMA , (vii) SWARNA BAIBHAV and (viii) RITA

3. Results and Discussion

Table 1: Germination Percentage

S.No	Variety of tomato	No. Of seeds germinated(Ng)	Total number of seeds(Nt)	Germination Percentage (GP)
1	S-22	26	30	86
2	MSN-55	30	30	100
3	BSS908 PRIYA	29	30	96
4	ES2205 PARAM	29	30	96
5	RITA	27	30	90
6	SWARNA BAIBHAV	28	30	93
7	SWARNA LALIMA	24	30	80
8	SWARNA SAMAPADA	23	30	76

Table 2: Mean Germination Time/ Mean Emergence Time (MGT)

S.No	Variety of tomato	Mean Germination Time(MGT)
1	S-22	1.08
2	MSN-55	0.93
3	BSS908 PRIYA	0.96
4	ES2205 PARAM	0.96
5	RITA	1.03
6	SWARNA BAIBHAV	1.00
7	SWARNA LALIMA	1.16
8	SWARNA SAMAPADA	1.21

Table 4: Germination and seedling growth parameters

S.No.	Variety of tomato	Plumule length(cm)	Radicle length(cm)	Plumule dry weight(g)	Radicle dry weight(g)
1	S-22	6.26	5.23	0.05	0.02
2	MSN-55	3.30	5.25	0.01	0.02
3	BSS908 PRIYA	5.13	4.30	0.02	0.01
4	ES2205 PARAM	3.90	5.50	0.01	0.02
5	RITA	5.46	7.23	0.03	0.05
6	SWARNA BAIBHAV	4.10	2.86	0.01	0.002
7	SWARNA LALIMA	5.10	4.40	0.02	0.02
8	SWARNA SAMAPADA	7.16	6.23	0.06	0.03

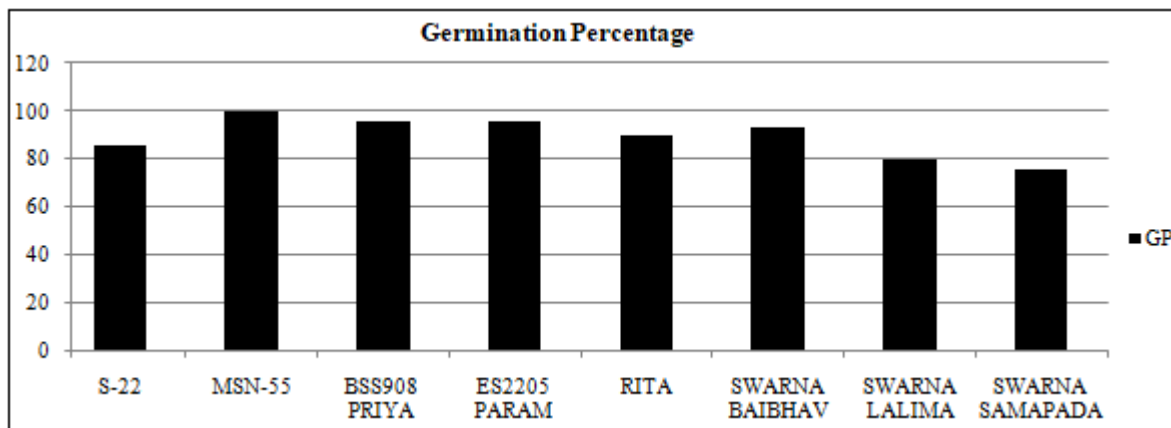


Figure 2: Graph showing Germination Percentage of different varieties of tomato

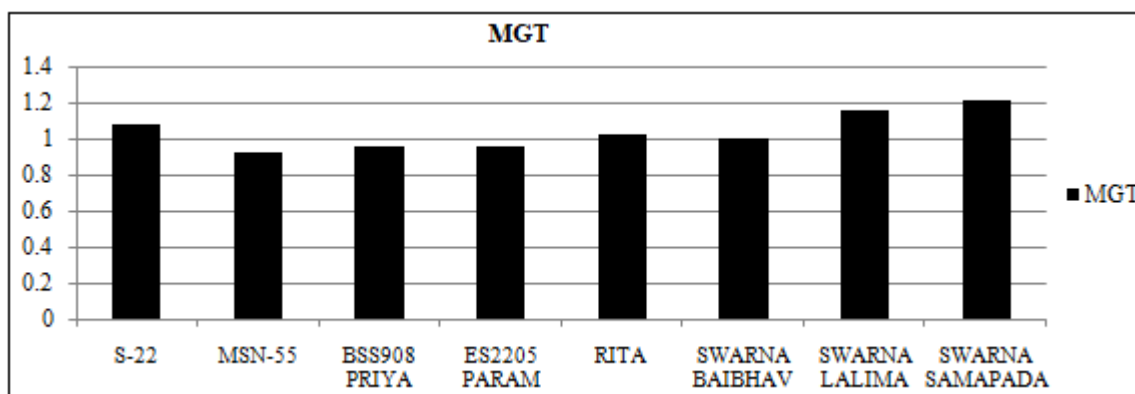


Figure 3: Graph showing Mean Germination Time of different varieties of tomato

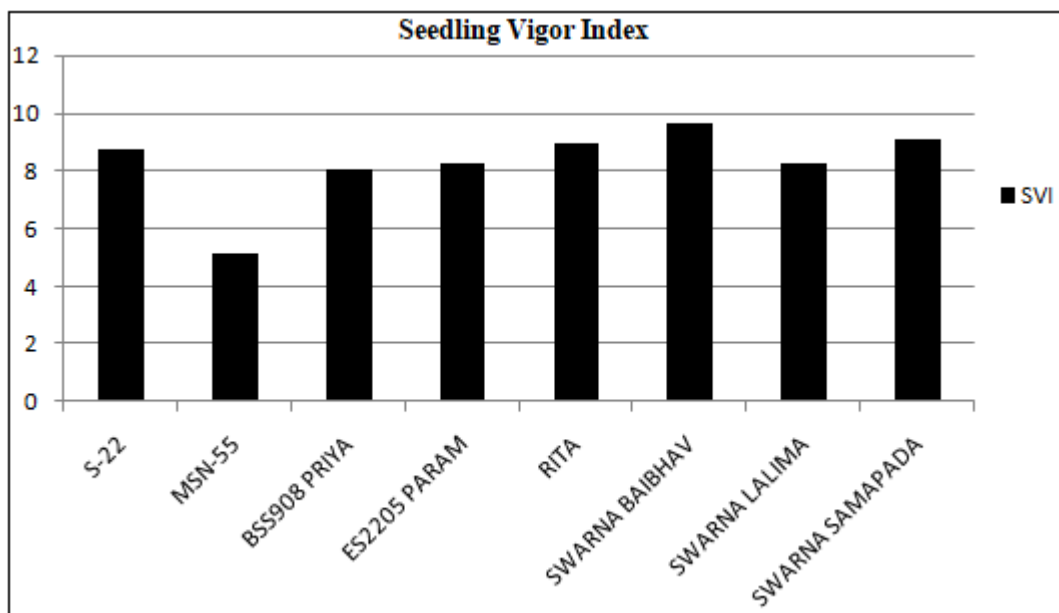


Figure 4: Graph showing Seedling Vigour Index of different varieties of tomato

4. Discussion

Table 1 show that the germination percentage of MSN-55 is maximum i.e.100%, followed by 96% of two other varieties BSS908 PRIYA and ES2205 PARAM. While the mean germination time was observed to be maximum. for Swarna Sampada i.e. 1.2 days, followed by Swarna Lalima and S-22 with value 1.16 and 1.08 respectively. The Seedling Vigour Index was found to be maximum for Swarna Baibhav i.e. 9.67, followed by that of Swarna Sampada, i.e. 9.12. The

different growth parameters of the seedlings were also studied like height and weight of seedlings, plumules and radicles which were helpful in determining the growth quality of the chosen varieties.

5. Conclusion

Germination of seed is an important characteristic for seedling establishment and subsequent plant health and vigour. Tomato is one of the important vegetable crop plants

which is a rich source of antioxidants and ascorbic acid and can help in alleviating the problem of nutritional gaps among the people. The different varieties grown in the different regions of Jharkhand state were taken into account for establishing seedling vigour index and to determine the growth parameters of the respective varieties.

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