DOI: 10.5281/zenodo.6038510

Canadian Journal of Agricultural and Applied Sciences
CJAAS (2021) 1(1):25-29 ISSN- 2816-2358
(October-December, 2021)

Effect of tomato hybrids to different growing media and fertigation on soil properties under naturally ventilated polyhouse

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Abstract:

The present investigation was conducted to study the response of different growing media and fertigation on yield and yield attributes of tomato in different tomato hybrids (Avtar, Rakshita and Naveen 2000 plus). This experiment was conducted at the Research Farm of Department of Agricultural Engineering, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur during summer season of 2013 and 2014 under naturally ventilated polyhouse. The research trial was laid out with treatments comprising three hybrids (Avtar, Rakshita and Naveen 2000 plus), three fertigation levels (NPK @ 20:20:20 g/m^2, NPK @ 25:25:25 g/m^2 and NPK @ 30:30:30 g/m^2) and two growing media (vermicompost and cocopeat: vermicompost) with randomized block design (RBD) and three replications. The data recorded for both the years *i.e.,* 2013 and 2014. The recorded soil pH and organic carbon was not affected significantly by different hybrids, fertigation levels and growing media. Maximum available nitrogen (289.5 kg/ha in 2013 and 295.1 kg/ha in 2014), phosphorous (25.7 kg/ha in 2013 and 27.0 kg/ha in 2014) and potassium (262.0 kg/ha in 2013 and 270.9 kg/ha in 2014) in the soil were observed at NPK @ 30 g/m^{2}which were significantly higher than NPK @ 25 g/m^{2}and NPK @ 20 g/m^2. Different hybrids and growing media during both the years could not exhibit any significant effect on available nitrogen, available phosphorus and available potassium of soil after the harvest of tomato crop.

Key Words: Tomato, hybrids, growing media, fertigation, naturally ventilated polyhouse, soil pH, organic carbon and available NPK.

Tomato (*Solanum lycopersicum* Mill.), member of solanaceae family, is one of the most important vegetable crops grown throughout the world. Tomato has attained a status of high value crop in India in recent years with an area of 882 thousand ha with a production of 18735.9 thousand MT with a productivity of 21.2 MT/ha [1] and occupies a pride place among vegetables in Indian cuisine because of its delicacy and pleasant flavour. At present, cultivation of tomato in open fields is a widespread practice in Himachal Pradesh. But the tomato crop grown in open fields is exposed to various abiotic and biotic stresses and therefore, it is not possible to produce high quality tomato in terms of size, shape, and colour and free from diseases and pests as compared to tomato produced under protected environment. With the increasing zeal

Received on - August 30, 2021 Accepted on - December 18, 2021 Published on - December 27, 2021

for its cultivation, the farmers are aptly looking towards improved varieties to meet out the higher standards of quality and quantity. Among tomato cultivars, hybrids have really brought the revolution in tomato cultivation. Other important component of growing crops under protected conditions is growing media and application of fertilizers with the irrigation water called fertigation which influences productivity and quality of tomato. Tomato is a warm season tropical crop and lacks adaptability to varied environmental conditions. Due to the behavior of weather, the crops grown in open fields are often exposed to fluctuating levels of temperature, humidity, wind flow *etc*. which ultimately affect the crop productivity adversely [2]. At present, cultivation of tomato in open fields is a widespread practice in Himachal Pradesh. To prevent tomato crop from various abiotic and biotic stresses and produce high quality tomato there is a need of protected environment. Therefore, it makes imperative to take up tomato cultivation under polyhouse.

METHODOLOGY

The experiment was conducted in naturally ventilated polyhouse during summer-season (March to August) in the year 2013 and 2014 at the Research Farm of the Himachal Pradesh Krishi Vishvavidyalaya Palampur. The area represents the sub-humid mid hill zone of Himachal Pradesh and is characterized by the sub-tropical climate. Mild summer and cool winter characterized the climate of Palampur. The seeds of the three hybrids were sown in plastic plug trays by using soilless media having cocopeat, perlite and vermiculite in the ratio of 3:1:1, respectively inside the naturally ventilated polyhouse on 20th Feb 2013 and 2014 to get healthy and disease-free seedlings of tomato. The seedlings were ready for transplanting after one month of sowing and were subsequently transplanted inside the naturally ventilated polyhouse equipped with drip irrigation system. Before transplanting, beds were prepared. These beds were thoroughly sterilized with 4 per cent formalin (1 litre of 40 per cent commercial formalin in 7 litre of water). Beds were covered with black polyethylene sheet for 7 days after formalin application. Then polyethylene sheet was removed, and soil raked well for a week to remove the fumes of formalin. Before transplanting, beds were prepared with growing media comprising of vermicompost alone and mixture of cocopeat and vermicompost (1:1, v/v) up to 15 cm depth. The basal dose of N, P and K @ 100 kg/ha from straight fertilizers was applied in the form of urea (21.5 g/m^2), single super phosphate (62.5 g/m^2) and muriate of potash (16.5 g/m^2). Remaining dose of NPK was applied with water soluble fertilizer (polyfeed 19:19:19) starting from 3rd week after transplanting and up to 15 days prior to final harvest. Fertigation was done twice a week. The plants were irrigated daily with drip irrigation system, one dripper was provided for each plant. Plants were watered regularly before 12 noon or late evening. Other cultural practices and standard plant protection measures were also adopted from time to time to ensure healthy crop stand. After 30-35 days of transplanting, plants were trained to 2 stems and staked with the help of nylon threads connected to the wire inside the polyhouse. Other cultural practices and standard plant protection measures were also adopted from time to time to ensure good and healthy crop stand.

There were eighteen treatment combinations comprising of three hybrids, two growing medium and three fertigation levels of NPK. Observations recorded were soil pH, O.C. (%), available nitrogen, phosphorus and potassium (kg/ha)

Result and Discussion

Soil pH

An examination of Table 1 indicated that soil pH was not affected significantly by different hybrids, fertigation levels and growing media during both the years.

Organic carbon

It is apparent from the Table 1 that different hybrids, fertigation levels and growing media during both the years could not exhibit any significant effect on organic carbon content of soil after the harvest of tomato crop.

Available nitrogen (kg/ha)

It is apparent from the Table 1 that different hybrids and growing media during both the years could not exhibit any significant effect on available nitrogen in soil after the harvest of tomato crop. Different levels of fertigation had significant influence on available nitrogen in the soil in both the years. Among different levels of NPK application, maximum available nitrogen in the soil (280.5 kg/ha in 2013 and 295.1 kg/ha in 2014) were observed at fertigation level of NPK @ 30 g/m^2 which were significantly higher than NPK @ 25 g/m^2 (271.8 kg/ha in 2013 and 289.7 kg/ha in 2014) and NPK @ 20 g/m^2 (263.3 kg/ha in 2013 and 272.6 kg/ha in 2014). Lowest amount of available nitrogen in soil after harvest was observed at NPK @ 20 g/m^2 during both the years. Similar observations have also been reported by [3].

Table 1: Soil pH, O.C. (%), available nitrogen, phosphorus and potassium (kg/ha) as influenced by different treatments

Treatments	pH		O.C. (%)		Available Nitrogen (kg/ha)		Available Phosphorus (kg/ha)		Available Potassium (kg/ha)	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
Hybrids										
Rakshita	5.80	5.82	0.94	0.95	271.2	285.8	22.5	25.3	235.9	243.1
Naveen 2000 plus	5.84	5.86	0.93	0.94	270.8	284.5	20.6	22.4	234.4	240.5
Avtar (7711)	5.71	5.75	0.91	0.93	273.6	287.1	23.5	25.1	237.4	245.4
SEm±	0.10	0.10	0.02	0.02	1.3	1.4	0.6	0.7	1.8	1.9
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Fertigation levels										
NPK @ 20:20:20 g/m^2	5.72	5.73	0.90	0.91	263.3	272.6	18.6	21.1	217.9	222.7
NPK @ 25:25:25 g/m^2	5.81	5.82	0.94	0.94	271.8	289.7	22.3	24.7	227.8	235.4
NPK @ 30:30:30 g/m^2	5.85	5.86	0.94	0.95	280.5	295.1	25.7	27.0	262.0	270.9
SEm±	0.10	0.10	0.02	0.02	1.3	1.4	0.6	0.7	1.8	1.9
CD (P=0.05)	NS	NS	NS	NS	3.9	4.0	1.8	1.9	5.4	5.6
Growing media										
Vermicompost	5.80	5.81	0.93	0.94	271.4	285.5	20.8	23.2	235.0	242.1
Cocopeat: Vermicompost (1:1)	5.84	5.85	0.94	0.95	272.3	286.1	23.6	25.3	236.8	243.9
SEm±	0.8	0.8	0.01	0.01	1.1	1.2	0.4	0.5	1.5	1.6
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Available phosphorus (kg/ha)

Different hybrids and growing media during both the years could not exhibit any significant effect on available phosphorus in soil after the harvest of tomato crop. Different levels of fertigation also had significant influence on available phosphorus in the soil both the years (Table 1). Among different levels of NPK application, maximum available phosphorus in the soil (25.7 kg/ha in 2013 and 27.0 kg/ha in 2014) was observed at NPK @ 30 g/m^2 which were significantly higher than NPK @ 25 g/m^2 (22.3 kg/ha in 2013 and 24.7 kg/ha in 2014) and NPK @ 20 g/m^2 (18.6 kg/ha in 2013 and 21.1 kg/ha in 2014). Lowest amount of available phosphorus in soil after harvest was observed at NPK @ 20 g/m^2 during both the years. Similar observations have also been reported by [3].

Available potassium (kg/ha)

The data pertaining to hybrids, fertigation levels and growing media on available potassium in soil after the harvest of the crop have been presented in Table 1. Different hybrids and growing media during both the years could not exhibit any significant effect on available potassium in soil after the harvest of tomato crop. Different levels of fertigation also had significant influence on available potassium in the soil both the years. Among different levels of NPK application, maximum available potassium in the soil (262.0 kg/ha in 2013 and 270.9 kg/ha in 2014) was observed at NPK @ 30 g/m^2 which were significantly higher than NPK @ 25 g/m^2 (227.8 kg/ha in 2013 and 235.4 kg/ha in 2014) and NPK @ 20 g/m^2 (217.9 kg/ha in 2013 and 222.7 kg/ha in 2014). Lowest amount of

available potassium in soil after harvest was observed at NPK @ 20 g/m^2 during both the years. Similar observations have also been reported by [3].

CONCLUSION

- Soil pH and organic carbon was not affected significantly by different hybrids, fertigation levels and growing media.
- Maximum available nitrogen (289.5 kg/ha in 2013 and 295.1 kg/ha in 2014), phosphorous (25.7 kg/ha in 2013 and 27.0 kg/ha in 2014) and potassium (262.0 kg/ha in 2013 and 270.9 kg/ha in 2014) in the soil were observed at NPK @ 30 g/m^2which were significantly higher than NPK @ 25 g/$m^2$and NPK @ 20 g/m^2.
- Different hybrids and growing media during both the years could not exhibit any significant effect on available nitrogen, available phosphorus and available potassium of soil after the harvest of tomato crop.

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