

# Performance of Tomato Varieties in Tunnel House and Efficacy of Different Treatments for Root Knot Nematode Management

R. Simkhada<sup>1</sup> and D. Pokharel<sup>2</sup>

## ABSTRACT

*Four commercially available tomato (*Lycopersicon esculentum*, Mill) varieties: Srijana, Thims 1, Thims 16 and Bishesh were grown in Dhikurpokhari, Kaski to characterize their morpho-physiological traits and select the best variety for the hill condition to boost tomato yield in plastic house. Thims16 produced highest yield/plot (330 kg) followed by Sirjana (311 kg). The highest fruit weight was for Thims1 (78 g), and the lowest for Bishesh (31.8 g). TSS value was statistically similar ( $P>0.05$ ) among the tomato varieties. Besides, this research was aimed to develop suitable management option to manage root knot nematodes (*Meloidogyne* spp.) grown under plastic house. Six types of treatments (mustard cake @ 50g, poultry manure @ 100g, ormicomin @ 50g, furadan 3G @ 1g and neemajin @ 1g per plant basis) with control were tested. Ormicomin was the most effective treatment, which resulted lowest score of nematode in both root and stem followed by poultry manure and Mustard cake. Neemajin and furadan showed lowest impact on reducing nematode score.*

**Key words:** Furadan, *Lycopersicon esculentum*, ormicomin, performance, Thims 16

## INTRODUCTION

Tomato is one of the most important commercial vegetable crops grown in Nepal (Ghimire et al., 2000). Because of climatic variations in the country, tomato is grown during winter in terai and inner-terai, during spring in low altitudinal vallies and during rainy season in mid hills. Tomatoes were generally grown in open condition; recently cultivation of hybrid tomatoes under plastic houses being popular. This technique has made possible to expand production period and thereby increase productivity. However, the technique has become risky in terms of significant losses due to pests and diseases. Root knot nematodes have been destructive in tomato (Sasser, 1980), especially when grown in regions of wide weather fluctuation. Nematode alone can cause 13 to 70% yield reduction in different situations. Probably every form of plant life is fed upon by at least one species of nematode (Hameed and Singh, 1998). Kaski is one of the leading tomato producing districts under plastic houses, where large infestation of root knot nematodes followed by viral diseases, blight and wilt are reported (Shrestha and Kafle, 2009). Keeping this in view, a study was carried out to evaluate performance of different tomato varieties and nematode management practices.

## MATERIALS AND METHODS

Two separate studies on variety evaluation and root knot nematode management were conducted from July to December 2009. Naudada in Dhikurpokhari VDC of Kaski district was purposively chosen for this experiment because of tomato being a leading commodity and severity of nematode infestation there.

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<sup>1</sup> Tech. Officer, Agri. Res. Station (Hort.), Kaski, Nepal. Email: resona.simkhada@gmail.com

<sup>2</sup> Training Officer, Reg. Agri. Training Center, Pokhara, Nepal. Email: dgogene@gmail.com

Four cultivars of tomato namely Srijana, Thims 1, Thims 16 and Bishesh were tested under plastic tunnel. Srijana is a Nepali hybrid and others are imported ones. Eighteen plants for each of the varieties were planted at a spacing of 75cm x 55cm in a plot inside plastic tunnel and replicated five times. Well decomposed farm yard manure (FYM) @ 10mt/ha and chemical fertilizers @ 120:80:80kg NPK/ha were applied with half of the nitrogen split to apply after 30 days of basal application. Hoeing, weeding and irrigation were done as needed. Staking with wooden sticks was done at knee-high stage of the crop.

The cultivars were evaluated for their morphological characters such as plant height, number of branches per plant, number of flower clusters per plant, number of fruits per cluster and yield per plot. The plant height was taken after the plant attained maximum height. Weighing balance, vernier caliper and refractometer were used to measure fruit characters such as fruit weight, pericarp thickness and TSS respectively. Number of lobe per fruit was recorded by visual counting. The fruit attributes were recorded for each variety by taking average of randomly selected five fruits.

Each of the six treatments for nematode management was applied on 12 plants in a plot, and replicated five times. The treatments on per plant basis included 50g ormicomin (Neem cake based fertilizer), 1g Furadan (carbofuran 1.5kg a.i./ha), 100g poultry manure, 50g mustard

Table 1: Nematode infestation scoring criteria

Score	Description of galling
0	No galling
1	Very light galling with small galls
2	Light galling
3	Moderate galling
4	Large galling
5	Heavy galling and nematode reproduction

cake, 1g neemajin (neem based granule formulation) and control The treatments were applied after 30 days of transplanting. A plastic house of 60sqm area and 3.5 m in height was used for planting the experimental plants. Nematode infestation was visually scored on eight randomly chosen plants using 0-5 point scale (Table 1).

Yield related plant attributes and nematode infestation scores were recorded only once at the end of the experiment, and analyzed using M-STAT. Analysis of Variance (ANOVA) was carried out to test the treatment differences;  $\alpha$  level was set at 0.05; means were compared using LSD.

## RESULTS AND DISCUSSIONS

### Varietal Performance

Varietal difference for yield was statistically significant ( $P < 0.01$ ). The variety, Thims-16 (330kg) and Sirjana (311kg) produced higher yield per plot than other varieties. Lowest fruit yield was obtained from the variety Bishesh (Table 2).

Table 2: yield, plant height, number of branch, number of fruits and clusters

Variety	Plant height (cm)	Branch#/Plant	Fruit#/Plant	Cluster#/plant	Yield (kg)/Plot
Bishesh	210.00b	2.50	62.7b	13.50b	158.33c
Srijana	295.33a	3.00	135.2a	23.17a	311.67ab
Thims 16	308.83a	2.17	139.3a	25.50a	330.00a
Thims 1	307.00a	2.17	92.5b	19.83ab	275.83b
Fvalue	8.90**	2.16 ns	12.05**	5.76**	19.92**
CV%	13.84	26.69	24.03	25.96	15.73
Lsd	47.72	-	31.77	6.548	52.07

Means in row with different letters in columns are significantly different ( $P < 0.05$ )

\*significant at 5% ( $P < 0.05$ ) \*\*significant at 1% ( $P < 0.01$ ) <sup>ns</sup> non-significant at 5 % ( $P > 0.05$ )

Plant height of different varieties of tomato used for the study was significantly ( $P < 0.05$ ) different. Accordingly, the highest plant height was recorded in Thims-16 (308 cm), Thims-1 (307cm) and Srijana (295.3cm). On the other hand lowest plant height was for the variety Bishesh (Table 2). Number of branches per plant was statistically similar among the tomato varieties. The number of branches ranged from 2.17 in Thims-1 and Thims-16 to 3 in Srijana. Total number of fruit per plant was highest for Srijana (135) and Thims-16 (139), whereas the lowest number of fruit per plant was for the variety Bishesh (62). Number of cluster per plant ranged from 13 to 25. The number of clusters per plant was statistically insignificant in Thims -16 (25.5), Srijana (23.17) and Thims-1 (19.83). Lowest number of clusters per plant was found in the variety Bishesh (Table 2).

Number of fruit per cluster remained statistically similar ( $P > 0.05$ ) among the varieties under study that ranged from 4.6 to 5.6. But, fruit weight was statistically different ( $P < 0.01$ ) among the tomato varieties (Table 3). For example, the highest fruit weight was found in Thims-1 (78 g) with the lowest in Bishesh (31.8 g). With respect to fruit size Thims-16 was close to Thims-1, and the Shrijana was close to Bishesh. Pericarp thickness was statistically similar among the tomato varieties that was about 4mm for all the varieties studied with the slightly highest value for the variety Thims 1 (Table 3).

Likewise, TSS value was also statistically similar ( $P > 0.05$ ) among the tomato varieties under study. However, numerically Srijana (4.62) had highest and Thims-1 (4.1) had the lowest TSS. Number of locules was statistically different ( $P < 0.01$ ) among the tomato varieties under study. Thims-16 and Thims-1 had highest number of locules that were statistically different to the variety Bishesh and Srijana (Table 3).

Table 3: Number of fruit/cluster, fruit size, pericarp thickness, TSS and number of lobe

Variety	Fruit#/cluster	Fruit weight (g)	Pericarp thickness (mm)	Total soluble solid (degree brix)	Locules#/fruit
Bishesh	4.833	31.87b	4.02	4.40	2.17b
Srijana	5.667	36.50 b	4.37	4.62	2.17 b
Thims 16	5.667	68.83 a	4.60	4.55	3.50a
Thims 1	4.667	78.75a	4.90	4.10	3.25a
Fvalue	1.45ns	16.68**	1.89ns	2.46ns	9.44**
CV%	20.81	25.88	14.86	8.12	20.29
Lsd	-	17.79	-	-	0.698

Means in row with different letters in columns are significantly different ( $P < 0.05$ )

\*significant at 5 % ( $P < 0.05$ ) \*\*significant at 1 % ( $P < 0.01$ ) <sup>ns</sup> non-significant at 5 % ( $P > 0.05$ )

A strong positive correlation was found between the traits such as number of fruits per plant, number of cluster per plant and yield per plot. Accordingly, an increment in fruit cluster per plant resulted acceleration in fruit number, clusters and finally yield per plot.

#### **Effect of different treatments on root-knot nematode of tomato**

Ormicomin was found the most effective treatment which resulted lowest scoring of nematode (0.0040/plant) in both root and stem. Though statistically different ( $P > 0.05$ ) from ormicomin, poultry manure and mustard cake were also found beneficial to reduce nematode infestation in tomato. On the other hand other treatments like control, neemajin, and furadane had lowest impact on reducing score of nematode infestation in root of the plant (Table 4).

Lowest scoring of nematode infestation on stem was obtained by the use of ormicomin (0.0040 per plant) followed by use of poultry manure. However, these treatments had statistically similar scores. Use of mustard cake and furadane also had low score, but higher than the use of ormicomin and poultry manure. On the other hand use of furadane, neemajin and control treatments all had comparatively higher score of nematodes on the stem (Table 4).

Table 4: Scoring of nematodes in root and stem of tomato grown under plastic house

Treatments	Root	Stem
Ormicomin	0.040c	0.040c
Furadane	3.440a	0.840ab
Poultry manure	1.080b	0.360bc
Neemajin	3.640a	1.080a
Mustard Cake	1.080b	0.760ab
Control	3.920a	1.120a
F-Value	30.25	0.0048
CV%	18.73	25.41
Lsd (P<0.05)	0.77	0.57

## CONCLUSION

Results of this study clearly revealed that the most effective treatment to manage nematode infestation in the stem as well as root of tomato was ormicomin, which suggested the need of re-visiting traditional concept of effectiveness of furadan at least to tackle with changed adaptation of nematodes against the established practices in tomato cultivation under plastic house condition. Besides, reasonable effectiveness of poultry manure and mustard cake in managing nematode population, the study further suggests the need of analyzing underlying properties of these treatments so that safe and organic approach of nematode control would be possible.

Thims-16 and Srijana are better varieties for plastic house cultivation in mid-hill condition based on plant growth, crop yield and fruit quality, which are in general preferred by consumers in terms of market demand and shelf life.

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