Journal of Natural Sciences Research www.iiste.org
ISSN 2224-3186 (Paper) ISSN 2225-0921 (Online)
Vol.5, No.20, 2015

# Tomato Management Practices and Diseases Occurrence in Mwea West Sub County

Margaret W. Mwangi[1]* J. W. Kimenju[1] R. D. Narla[1] G. M. Kariuki[2] W. M. Muiru[1]
1.Department of Plant Science and Crop Protection, University of Nairobi, P.O. Box 29053 Code 00625 Kangemi Nairobi, Kenya
2.Department of Agricultural Science and Technology Kenyatta University P.O. Box 43844 Code 00100 GPO Nairobi, Kenya

**Abstract**

Tomato is an important crop in Mwea West Sub County, Kirinyaga County, Kenya. A survey was carried out in the area to investigate tomato management practices, diseases and pests that hinder tomato production. The study endeavoured to establish farmers' knowledge on fusarium wilt disease and root-knot nematodes and the methods used to control them. Data was collected from two hundred and eighteen randomly selected small holder producers who were equally distributed in the study area. Data collected included tomato management practices, diseases and pests that hinder production. Majority (85.3%) of the respondents were males while a few (14.7%) were female. The respondents (71.6%) indicated that tomato was the most important crop grown for income generation in the area. Most important varieties grown were cultivars, Safari, Kilele F1, Prosta F1 and Rio- Grande. Most important diseases affecting tomato crop were; early blight (*Alternaria solani*) and late blight (*Phytophthora infestans*), fungal wilts (*Fusarium* sp. *Verticillium* sp. *Rhizoctonia* sp.) and bacterial wilt (*Ralstonia solanacearum*). Plant parasitic nematodes and pests (thrips, aphids, spider mites) were also reported in the study area. There was a significant($P<0.05$) association between the following variables; type of land owner and major use of land, type of land owner and cropping system, source of agricultural information and whether or not to apply pesticides into the soil. Farmers were quite knowledgeable about tomato farming as they had access to information from various sources; however there are still major gaps in knowledge especially on diseases and pests.

**Keywords:** Tomato, diseases, pests, nematodes, management

## 1. Introduction

Tomato is one of the most widely grown vegetable food crops not only in Kenya but also in East Africa and the whole world at large, second only to potato (FAO 2005; Maerere *et al*. 2006). The crop is one of the most highly consumed vegetable crops in Kenya (National farmers information service). Very large quantities of tomatoes are processed and preserved in a variety of forms. Much of the volume of processed tomatoes is packaged as tomato paste and used to make products such as juice, sauces and soups (FAO 2000). In Kenya, tomato is an important economic activity for small holder farmers.

Mwea region, formerly a division in Kirinyaga district has recently been divided into Mwea East and Mwea West Sub Counties in Kirinyaga County (Kenya county guide). Mwea West Sub County has four wards namely Mutithi, Thiba, Kangai, Kandongu. It is a low midland agro ecological zone characterised by gentle rolling plains. Water from the rivers Nyamidi, Rupangazi, Thiba, Rwamuthumbi and Ragati has been harnessed through canals and support irrigation in Mwea (Kenya county guide). The area has an average rainfall of 1100- 1250 mm per year and a temperature range of $12^0$C to $26^0$C. The major economic activity is agriculture.

## 2. Materials and methods

A survey was carried out at the household level to establish management practices and disease constraints that hinder tomato production. The study was conducted through personal interviews and use of a semi structured questionnaire. All possible forms of answers were provided in the structured questions while in the unstructured questions, the respondents provided answers from their own perspectives. The questionnaire endeavoured to gather information on household characteristics, land use practices and most important crops grown in the area. Other important information was main tomato varieties, diseases and pests of tomatoes and the methods farmers used to control them. The questionnaire was also designed to generate information on farm inputs, source of seedlings and source of agricultural information from the respondents. Only farmers who had planted tomatoes were interviewed. The survey included 218 randomly selected tomato growers. Frequency tables were used to estimate the sample size (Krejcie & Morgan 1970). Before launching the survey, the questionnaire was pretested and improved accordingly. The data was entered into SPSS statistical programmes for social sciences (IBM SPSS Statistics 20). A spreadsheet was developed and all information gathered using the questionnaires entered. Selected data analysis was carried out using SPSS data analysis options including frequency tables and bar charts. Chi-sq. tests were used to determine association between variables.

## 3. Results

### 3.1 Social economic characteristics of respondents

The study showed male dominance in tomato production in the study area. Majority (85.3%) of the respondents were males while 14.7% percent were females (Table 1). Fifty six percent of farmers interviewed were between the ages of 20-40 while 28.4% were in the age group of 41-50 years, and the rest (15.6%) were above 51 years. The farmers in the study area were literate with 47.7% of the respondents having primary education, 45.9% secondary education and 6.5% had tertiary education. Acquisition of land for tomato cultivation was not a major concern in the area of study. Most respondents planted

tomatoes on their own land (43.1%); another (45%) used family land; while 11.9% rented land (Table 1).

There was a relationship between the type of landowner and the major use of land, whether for income generation or providing food for the family (Chi-Sq =11.65 DF=2 P-Value = 0.03 (Table 2)). Most landowners (74.2%) indicated that the main use was income generation and this was significantly (P<0.05) different from those who rented land whose sole purpose (100%) was income generation Table 2.

Farm sizes ranged from 0.25acres – 14 acres with majority of farmers having a farm size in the range of 0.25 to 4 acres as shown in Fig.1

**3.2 Crops grown and cropping patterns in the study area**

Tomato was the most important crop grown by the farmers interviewed (71.6%) followed by maize (13.8%) and French beans (11.9%) as shown in Table 3. Tomatoes and French beans were mainly grown for income generation while maize was for household consumption.

The survey showed that majority of the farmers (79.8%) practiced mono-cropping while 20.2% intercropped the tomato crop with maize and beans (Table 3). There was a relationship between the type of cropping pattern and the type of landowner (Chi-Sq = 7.028 DF=2 P- Value = 0.030). Forty percent of those who rented land practised intercropping and this was significantly (P<0.05) different from 14.1% who practised intercropping and who were the land owners. The farmers indicated that they practised mono-cropping to avoid disease transmission and competition from other crops while those who intercropped with other plants did so in order to minimize the risks of crop failure and maximize on returns. The farmers also indicated that they practiced crop rotation. They rotated the tomato crop with maize, beans, French bean and sweet potatoes.

The farmers grew a wide variety of tomatoes (Fig. 2). Cultivars, Safari and Kilele F1 were the most popular with frequencies of 30.35% and 26.6% respectively.

**3.3 Diseases and pests that affect tomato crop**

The most important diseases recorded were early blight and late blight (53.8%) followed by wilt diseases (32.1%), nutritional diseases (6.6%), nematodes (3.8%) and pests (3.8 %) as shown in Table 4. Majority of farmers indicated that blight disease could easily be controlled by regular spraying using fungicides like Ridomil and Dithane M45. Majority (91%) of the respondents had observed wilting of tomatoes in their farms. Observation of tomato plants in the field and preliminary investigations of diseased plant materials in the laboratory indicated that wilting could have been caused by the bacteria *Ralstonia solanaceaerum* or by fungi *Rhizoctonia solani*, *Verticillium* sp. or *Fusarium* sp. Wilting would cause yield losses of 1-10 % according to 57.8 % of the respondents (Table 4).

Majority (74%) of the farmers reported that wilting was caused by a pathogen found in the soil. Others (21%) indicated that it was spread in irrigation water, while still others (5%) did not know the causes of the wilting. The respondents indicated that they used various methods to control wilting. The findings indicate that 40.6% uprooted the diseased plants while 21.8% sprayed chemicals such as Ridomil Gold. Other methods of controlling wilting included crop rotation, use of resistant varieties and watering (Table 4). A small percentage of the farmers (15.8%) did not use any method to control the wilt (Table 4). In the survey, 3.8% of the farmers indicated that diseases induced by nematodes were the most important diseases on tomato plants in the field. Various methods were used by farmers to control nematodes; applying chemicals (48.6%), watering (19.2%), spraying (9.6%), use of resistant varieties (5.8%), adding manure (3.8%), crop rotation (1.9%) and adding ash (1.9%). The survey observed that 9.6% of respondents did not know of any methods that could be used to control nematodes.

Findings of this study indicate that 48.6% of the farmers applied pesticides into the soil while 51.4% did not (Table 5). Farmers indicated that the diseases targeted in the soil included nematodes (27.5%) and pests (21%) such as aphids, thrips, spider mites. The most popular pesticide used was Mocap (14.7%). Application of chemicals into the soil to control nematodes was independent of age of the respondent. There was no significant (P<0.05) difference among the different age groups of those who applied pesticides into the soil and those who did not (Chi-sq=1.766 DF = 3 P-value=0.622).

**3.4 Sources of seedlings and agricultural information**

Most farmers (81.6%) got all their seedlings from their own tomato nurseries, while those who did not get enough from their nurseries bought from their neighbours. Farmers indicated that they got their seedlings from their own tomato nurseries because it was convenient to have the seedlings readily available and also to avoid disease transmission from other nurseries.

Majority (91.8%) of the farmers had access to agricultural information in the past one year. The most important way farmers gained information was by government staff through agricultural extension officers and field days (40.4%). Other important channels included other farmers (38.4%), agrovet-shops (12.1%) and mass media (9.1%) as shown in Table 6.

There was a significant (P<0.05) relationship, (Chi-sq =9.628 DF= 3 P-Value = 0.022) between the source of agricultural information and whether or not to apply pesticides Table 7. Most farmers (77. 8%) whose source of agricultural information was mass media applied pesticides and this was significantly different (P< 0.05) from 48.7% who also applied pesticides and whose source of agricultural information was government staff. Similarly, 51.3% whose source of agricultural information was government staff did not apply pesticides and this was significantly (P<0.05) different from 22.2% whose source of information was the mass media who did not apply pesticides.

**4. Discussion**

The male dominance (85.3 %) in tomato production in the area could be due to the fact that tomato production is capital intensive and men generally have greater access to capital than women. Anang *et al.* (2013) reported a similar outcome of males' majority in tomato production in Wenchi Municipal District of Ghana.

Majority of the farmers were young (20 – 40 yrs). They were in their energetic and productive years. This is an

indication that there may be a high potential for increasing tomato production in the area. Asare-bediako *et al.* (2007) reported a similar age distribution of tomato farmers at Bontanga irrigation project in Ghana.

The results indicate that the farmers in the area were literate and could understand many management practices, diseases and pests that affect tomatoes. Literacy is an important characteristic that influence production (Awan *et al.* 2012). Farmers in the area may easily adopt improved farming practices as they can fully comprehend the implications of such practices.

There was a tendency by the farmers to embrace new cultivars of tomatoes such as Rio-Grande, Kilele F1, Prostar F1 that were high yielding and resistant to diseases. Indeterminate varieties and hybrids such as Kilele F1, Prostar F1 are preferred by farmers due to a longer period of harvesting and higher yields. Rio-Grande though determinate has a long storage life. These tomato varieties popular in the area are documented as high yielding and resistant to various diseases, thus choosing these varieties increases tomato production.

The main reason for crop rotation was to break tomato disease cycles. The farmers rotated the tomato crop with non-solanaceous crops to break tomato disease cycles. The effectiveness of such crop rotation programmes in reducing wilt disease and nematodes might have been reduced by the fact that farmers had very small farm sizes (Fig 1.) and therefore could not afford the long rotational cycles (3 years) that is recommended to avoid pest problems and diseases common in tomatoes and other similar crops (Sally *et al.* 2006).

Forty percent of those who rented land practised intercropping and this was significantly ($P<0.05$) different from 14.1% who practised intercropping and were also the land owners. A higher percentage of those who rented land practised intercropping possibly in order to minimize the risks of one crop failing.

Farmers lacked knowledge on application of pesticides and their target pests. They indicated that pesticides were applied in the soil to control thrips, spider mites and aphids. These were misinformed since these pests are not found in the soil but in the leaves and are controlled by spraying. A similar observation that farmers do not have a thorough understanding of disease types and their control was also made in Kamuli, Uganda (Tusiime 2014). Tinyami, *et al*. (2014) gave a report on a survey carried out in Buea municipality in Cameroon indicating that farmers did not have a thorough understanding of wilting disease symptoms and nematodes. In this study, only about 3.8 % (Table 4) of the farmers recognised nematodes as a threat to tomato production. Oruko & Ndun'gu (2001) did a study in the same area and reported that only 2.5% of farmers recognized nematodes as an important disease constraint in tomato production. In this study there was no evidence that farmers applied any fungicides into the soil in order to control fusarium wilt (Table 4). A similar study in the area by Mugo (2012) also indicated that the farmers had a poor understanding of fusarium wilt. A report by tomato growers in Uganda also noted lack of awareness and unavailability of the systematic fungicides in the control of wilting (Ssemwogerere *et al.* 2013). Furthermore fusarium wilt pathogen and nematodes are found in the soil and the nematicide and fungicide must be delivered into the soil to make contact with the pathogens. This is not always possible as these pathogens will multiply within the plant tissues.

Majority of farmers (77.8%) whose main source of agricultural information was mass media applied pesticides into the soil compared to 48.7% whose source of agricultural information was government staff. The probable reason for this could possibly be due to the fact that mass media will aggressively advertise their products, while government staff will not necessarily emphasize on chemical control but will advocate for an integrated approach incorporating other methods like crop rotation.

Most farmers were knowledgeable about tomato farming and they got the information from many sources. Most respondents expressed great interest in learning more especially concerning diseases that were a challenge like the wilt diseases.

## 5. Conclusion

Farmers have a rich and in depth knowledge of tomato production through agricultural extension officers in the locality and other channels such as mass media and agro-vet shops, however there are still major gaps in knowledge, especially concerning the control of wilt diseases and nematodes. Therefore there is need to adopt IPM to effectively manage the nematodes and wilt diseases.

There is need to adopt methods of pest and disease control that is environmentally friendly and that do not affect human health. Ministry of agriculture and county governments should subsidize on the high cost of seeds and fertilizers in order to lower production costs.

**Acknowledgements**

The authors would like to acknowledge the following institutions for facilitating this study; The Ministry of Agriculture and the University of Nairobi.

## References

Anang, B. T., Zulkarnain, A. Z. and Yusif, S. (2013). Production constraints and measures to enhance the competitiveness of tomato industry in Wenchi Municipal District of Ghana. *American journal of Experimental agriculture* **3** (4), 824-838.

Asare-Bediako, E. Showemimo, F. A., Buah, J. N., and Ushawu, Y. (2007). Tomato production constraints at Bontaga Irrigation Project in the Northern Region of Ghana. *Journal of Applied Sciences* **7**, 459-461.

Awan, S. M., Hussain, Azhar, Abbas, T. and Karamu, R. (2012). Assessment of production practices of small scale farm holders of tomato in Bagrote Valley, CKNP region of Gilgit-Baltistan, Pakistan. *Acta Agriculture Slovenica* **99**(2),

191-199.
FAO (2000). FAOSTAT. Available from: http://www.faostat.fao.org.[ December 2014].
FAO (2005). FAOSTAT. Available from: http://www.faostat.fao.org. [December 2014].
Kenyacountyguide Kirinyaga county. Available from: www.kenyacounty guide.com. [January 2015].
Krejcie, R. V. and Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement* **30**, 607-610.
Maerere, A. P., Sibuga, K. P., Mwajombe, K. K. (2006). Baseline survey report of tomato production in Mvomero district-Morogoro region, Tanzania. Sokoine University of Agriculture Faculty of Agriculture, Morogoro, pp. 1-31.
Mugo, D. N. (2012). Integrated management of fusarium wilt of tomato using fungicides, organic matter and neem extract. MSc. Thesis, Kenyatta University, Kenya.
Sally, A. M., Randal, C. R. and Richard, M. R. (2006). Fusarium and Verticillium wilts of Tomato, Potato, Pepper and Egg plant. The Ohio State University Extension.
Ssemwogerere, C., Ochwo-Ssemakula, M. K. N., Kovach, J. Kyamanywa, and Karungi, J. (2013). Species composition and occurrence of thrips on tomato and pepper as influenced by farmers' management practices in Uganda. *Journal of Plant Protection Research*.**53** (2), 158-164.
Oruko, L. and Ndungu, B. (2001). Final social-economic report of the peri-urban vegetable IPM cluster. CABI/KARI/HRI/ University of Reading/IACR Rothamsted Collaborative Project.
Tinyami, E. T., Choi, J. W., Tumenta, T. S., Eko, A., Chick, O. A. (2014). Small-Scale tomato cultivators' perception on pesticides usage and practices in Buea Cameroon. *Health* **6**, 2945-2958.
National farmers information service tomatoes. Available from: www.nafis.go.ke/vegetables/tomatoes. [ September 2015[.
Tusiime, S. M. (2014). Evaluating horticultural practices for sustainable tomato production in Kamuli, Uganda. MSc. Thesis, Lowa State University, Ames Iowa.

**Table 1.Demographic characteristics of respondents**

| Characteristic | Number of respondents | Percentage of respondents |
|---|---|---|
| Gender | | |
| Male | 186 | 85.3 |
| Female | 32 | 14.7 |
| Age in years | | |
| 20-30 | 56 | 25.7 |
| 31-40 | 67 | 30.7 |
| 41-50 | 61 | 28 |
| 51 and above | 32 | 15.6 |
| Education level | | |
| Primary | 104 | 47.7 |
| Secondary | 100 | 45.9 |
| Tertiary | 14 | 6.5 |
| Type of land ownership | | |
| Own | 94 | 43.1 |
| Family owned | 98 | 45.0 |
| Rented | 26 | 11.9 |
| Total | **218** | **100.0** |

**Table 2. Relationship between type of ownership and allocation of land to different uses**

| Type of ownership | Food security | | Income generation | | Total number of farmers interviewed |
|---|---|---|---|---|---|
| | Count | % | Count | % | |
| Own | 28 | (19.8%) | 66 | (74.2 %) | 94 |
| Family owned | 18 | (18.4 %) | 80 | (81.6 %) | 98 |
| Rented | 0 | (0.0 %) | 26 | (100 %) | 26 |
| Total | 46 | | 172 | | 218 |

Chi-Sq =11.65 DF=2 P- Value = 0.03 P<0.05

**Table 3. Ranking of crops and cropping patterns**

| Characteristic | Number of respondents | Percentage of respondents |
|---|---|---|
| **Ranking of Crops** | | |
| Tomatoes | 156 | 71.6 |
| French beans | 26 | 11.9 |
| Maize | 30 | 13.8 |
| Beans | 2 | .9 |
| Bananas | 2 | .9 |
| Rice | 2 | .9 |
| Total | 218 | 100 |
| | | |
| **Cropping pattern** | | |
| Mono-cropping | 174 | 79.8 |
| Intercropping | 44 | 20.2 |
| | | |
| Total | 218 | 100 |

**Table 4. Prevalence of wilting and diseases and pests that affect tomato crop**

| Diseases affecting tomatoes | Percentage of respondents |
|---|---|
| Early and late blight | 53.8 |
| Wilting( nematodes, fungal and bacteria pathogens) | 32.1 |
| Nematodes | 3.8 |
| Nutritional deficiencies | 6.6 |
| Pests ( thrips, aphids, mites) | 3.8 |
| | |
| Plants affected by wilting | Percentage of respondents |
| 1-10% | 57.8 |
| 11-20% | 33.3 |
| 21-30% | 7.8 |
| 31-40% | 1.0 |
| | |
| Control of wilting | |
| | |
| Uprooting diseased plants | 40.6 |
| Spraying | 21.8 |
| No control measures | 15.8 |
| Crop rotation | 9.9 |
| Resistant varieties | 10.9 |
| Watering | 1.0 |
| Total | **100.0** |

**Table 5. Chemicals applied to control nematodes**

| Chemicals applied into the soil | Respondents |
|---|---|
| No application | 51.4 % |
| Mocap | 14.7 % |
| Acaricides | 4.6 % |
| Alpha | 3.6 % |
| Gaucho-xt | 3.6 % |
| Marshall 250EC | 0.9 % |

**Table 6. Most preferred sources of agricultural information**

| Source of agricultural information | Percentage of respondents |
|---|---|
| Government staff | 40.4 |
| Other farmers | 38.4 |
| Mass media | 9.1 |
| Agrovet- shops | 12.1 |
| Total | 100.0 |

**Table 7. Relationship of source agricultural information on application of pesticides into the soil**

| Source of agricultural information | Yes Count | % | No Count | % | Total number of farmers interviewed |
|---|---|---|---|---|---|
| Government staff | 38 | (48.7 %) | 40 | (51.3 %) | 78 |
| Mass Media | 14 | (77.8 %) | 4 | (22.2 %) | 18 |
| Other farmers | 36 | (50 %) | 36 | (50 %) | 72 |
| Agro-vet shops | 18 | (75 %) | 6 | (25 %) | 24 |
| Total | 106 | | 86 | | 192 |

Chi- sq =9.628 DF=3 P-Value = 0.022 P < 0.05

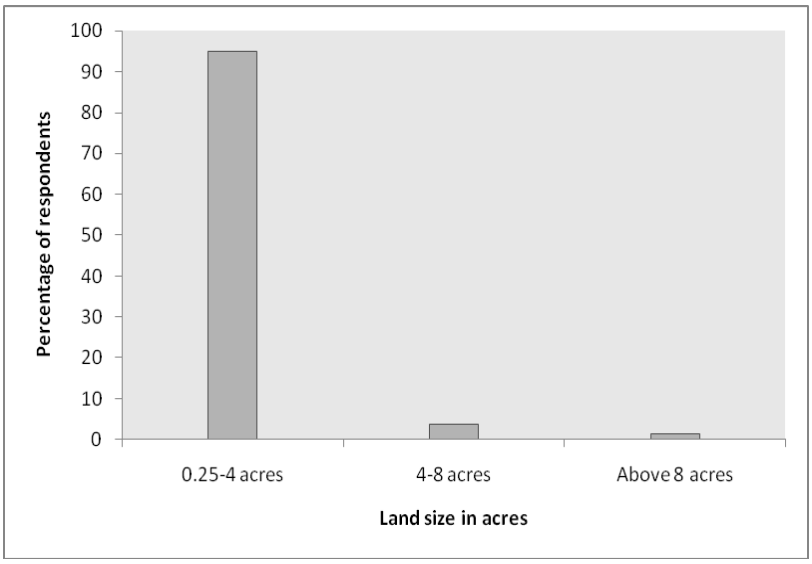


**Fig 1.Farm sizes of respondents**

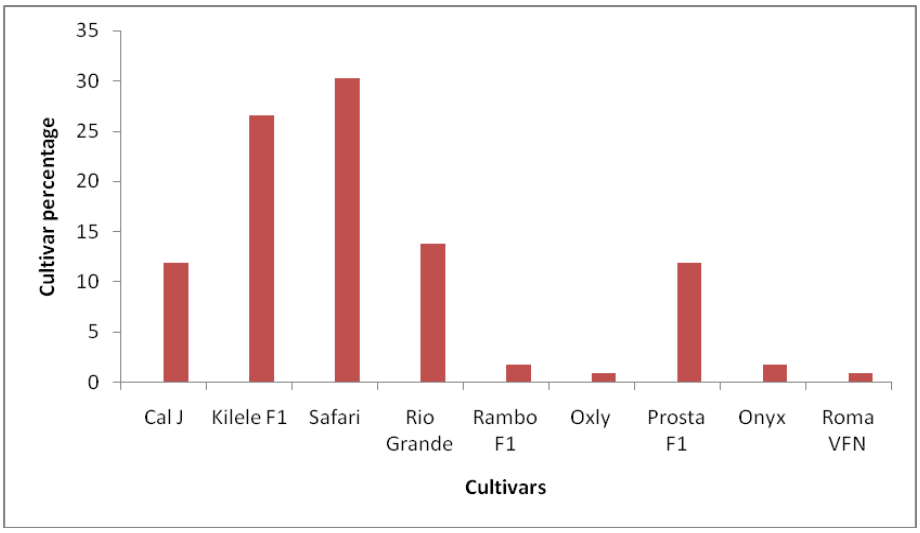


**Fig. 2.Tomato varieties grown by respondents**