Original Research Article

Evaluation of constraints limiting Passion Fruit (Passiflora Edulis Sims) Production in Uasin-Gishu County, Kenya

ABSTRACT

Aims: Passion fruit (*Passiflora edulis* Sims) is among the most important fruit crops in Kenya, that are produced for both local and export markets. In Uasin Gishu County, passion fruit had recently emerged as an important cash crop for the small-holder farmers. Despite the importance of passion fruit, its production in the county has declined.
Study design: Mention the design of the study here.
Place and Duration of Study: The objective of the study was to identify constraints limiting passion fruit production across all the six sub-counties in Uasin Gishu County between February 2017 and January, 2018
Methodology: The sample size of a total of 150 farmers used in the study was determined proportionately using the respective total population, where purposive sampling technique was used to select farmers for the study in passion fruit growing areas. Data was collected using a structured questionnaire that were personally administered to farmers who were growing the crop at the time of the survey. Besides the survey, focused group discussions were employed on both the farmers who were still growing the crop and those who had quit producing the crop. The data was subjected to descriptive analysis using SPSS software.
Results: The results showed that more than 50 % of the farmers were constrained by seed unavailability of quality seed source and high phenotypic variability within/between the farms, drought, pests, diseases, birds that destroyed the flowers and the fruits.
Conclusion: Understanding the challenges affecting passion fruit production is important when farmers continue to use passion fruit cultivars to form part of the conservation strategy, which leads to development of breeding programs for crop improvement according to their preferences and needs.

Keywords: Passion fruit, constraints, farmers, survey, production

Comment [AB1]: The aim of the study is not clear here.

Comment [AB2]: The study design has not been mentioned here.

Comment [AB3]: The study reported here had been conducted 5-6 years ago. More recent data of this study should have been included.

Comment [AB4]: Check formatting.

Comment [AB5]: The keywords are traditionally written in alphabetical order separated by semicolons.

1. INTRODUCTION

Passion fruit (*Passiflorae edulis* Sims) is the third most important fruit crop in Kenya earning a total of about 8% of foreign exchange among the horticultural produce in 2010 (1). Locally passion fruit consumption in Kenya has also gained importance due to the perceived beneficial health effects. Thus, the motivation for the increased production of passion fruit is due to the unlimited market demand for the fruit. In Uasin-Gishu County, Kenya, passion fruit had recently emerged as an important cash crop especially for the small-scale resource poor farmers.

Despite the significant economic importance of passion fruit in Kenya, its production has been on a decline with the average yields being relatively low at 8 ton ha-1 compared to a potential of 24 tonnes per hectare (2). The causes of the decline in passion fruit production in Uasin-Gishu County have not been documented. Among the constraints that have been reported to limit passion fruit production in other parts of Kenya are both biotic and abiotic (2).

In order to improve on the production of passion fruit in Kenya, it is important to establish the underlying causes for the low yields of the crop. Understanding the current distribution, severity and relative importance of passion fruit biotic factors will also be beneficial in addressing the low yields and decline in passion fruit production. This study was therefore conducted to establish the constraints limiting passion fruit production in Uasin-Gishu, County.

2. MATERIAL AND METHODS

2.1 Study area

The study was undertaken in all the six sub-counties of Uasin-Gishu County. The County measures approximately, 3,345.2 Km2 with a population of 894,175 people (4). Uasin-Gishu borders Elgeyo Marakwet to the East, Trans-Nzoia to the North, Kericho to the South and Bungoma and Nandi Counties to the West (4). The County has an average altitude of above 2000 metres above sea level (masl),temperature range of 8.4 – 27°C and bi-modal rainfall (long rains starting from mid-March to late May and short rains starts from mid-October to late December) (4). The average rainfall in the County is between 500-2600 mm per annum. Agriculture is the main economic activity in the County which is dominated by mixed farming systems (4).

Comment [AB6]: The longitudes and latitudes of the study area should be mentioned here.

2.2 Sampling design

A baseline survey using a purposive sampling was used to select the study population across all the sub-counties targeting passion fruit farmers. Respondents were identified with the assistance of County Agricultural extension officers. The sample size of farmers used in the study was determined proportionately using the respective total population of farmers producing passion fruit with a total of 150 farmers being sampled.

2.3 Data collection

2.3.1 Questionnaire survey

The aim of the survey through use of questionnaire was to obtain a general understanding of the production and marketing constraints, farmer's demographic information and the economic importance crop for one year (May 2011 to June 2012). The sampling frame entailed farmers who had 0.04 to 4 ha of their farms under passion fruit production.

Comment [AB7]: This data is more than a decade old. Some improvements in agricultural practices and policies must have taken place since then. The authors should include this recent data.

2.3.2 Focused group discussions (FGDs)

In some cases, FGDs were used to collected information from passion fruit farmers. The FGDs were structured and guided by the sets of questions complimenting the questionnaire. The FGDs involved a total number of 30 farmers (divided into groups of between 8-12 persons) from each sub-county currently producing passion fruit and those who have abandoned passion fruit farming. The responses from the FGDs were transcribed and key issues picked out for analysis.

2.4 Data analysis

Data from both the questionnaire and FGDs were analyzed by using Statistical Package for Social Sciences, version 20 (SPSS) to compute descriptive statistics. Analyzed data was expressed as graphs and percentages.

3. RESULTS AND DISCUSSION

About 92% of the passion fruit farmers assessed in the field was between had information on production and constraints of passion fruit (Table 1). The data showed that both men and women are involved in passion fruit farming although the majority of the farmers (91%) were male which implies that income generation is improved among the population. About 35.2 % of the farmers were age between 31 – 40 years which signifies that younger people are involved in purple passion fruit production and promotes employment and improves the livelihoods of people (5). The farmers used owned land (54.7 %) to grow passion fruit and most of the times supplemented their production by leasing additional land (45.3 %) which signifies that farmer go an extra mile to generate income from the crop for improved livelihood. It was also observed that 90% of the farmers interviewed have been growing passion fruit for more than 10 years. This indicates that farmers have been growing the crop for quite some time as a source income and employment as well as generating revenue for the government.

Due the enormous financial benefits derived from passion fruit, production of the crop has attracted growers from different backgrounds including, teachers, civil servants and retirees were among the farmers interviewed. It was also observed that some of the passion fruit farmers had resigned from employment to grow passion fruit. The study revealed that passion fruit production had become an important crop that can raise and sustain household income and livelihoods. The farmers interviewed considered the crop as one of the most profitable enterprise in the recent times (6).

Table 1: Respondent's percent (%) distribution according to their socio-demographic characteristics

Variable	Characteristic	Anapkoi	Kapseret	Kesses	Moiben	Kesses	Turb	
Age	< 30 years	4	7.8	10.2	8.6	5.4	11.7	8
	31 - 40 years	36.6	35.4	30.6	42.9	40.3	25.5	35.2
	41 - 50 years	27.2	42.5	39.2	27.2	32.6	31.6	33.4
	51 - 60 years	18.5	7.8	4.6	8.8	10.4	27.3	12.9
	> 61 years	13.7	6.5	15.4	12.5	11.3	3.9	10.5
Gender	Male	89	88.3	95.2	92.4	94.6	88.5	91.3
	Female	11	11.7	4.8	7.6	5.4	11.5	8.7
Education Level	None	10.6	6.3	12.4	9.7	5.7	10.8	9.3
	Primary	12.3	18.6	20.3	23.5	15.2	34.8	20.8
	Secondary	36.9	29.4	27.6	36.6	34.6	21.6	31.1
	Tertiary	40.2	45.7	39.7	30.2	44.5	32.8	38.9
Information production	Informed	86.7	95.1	92.3	90.4	89.3	96.1	91.65
	Not informed	13.3	4.9	7.7	9.6	10.7	3.9	8.35
Land ownership	Own	60.4	41.2	55.6	65.3	57.4	48.5	54.7
	Hired	39.6	58.8	44.4	34.7	42.6	51.5	45.3
Labour source	Entire family	42.2	37.1	32.4	28.6	30.4	41.2	35.3
	Hired	57.8	62.9	67.6	71.4	69.6	58.8	64.7

Comment [AB8]: The author(s) should clarify about these counties both in the text as well as this table in a row above this row as "Names of Counties".

However, extension and farmers indicated that the production has been on the decline in the past 5 years across all the sub-counties. Among the major constraints farmers identified across the County (Table 2); are lack of agronomic information, lack of good quality seedlings, prolonged drought, pests, and diseases and birds as the major constraints limiting passion fruit production (7; 8). Diseases (60.1 %) was reported as one of the major constraints limiting production of passion fruit in Uasin Gishu County (Figure 1). These

challenge have caused many farmers to quit passion fruit farming since it is no longer profitable (9).

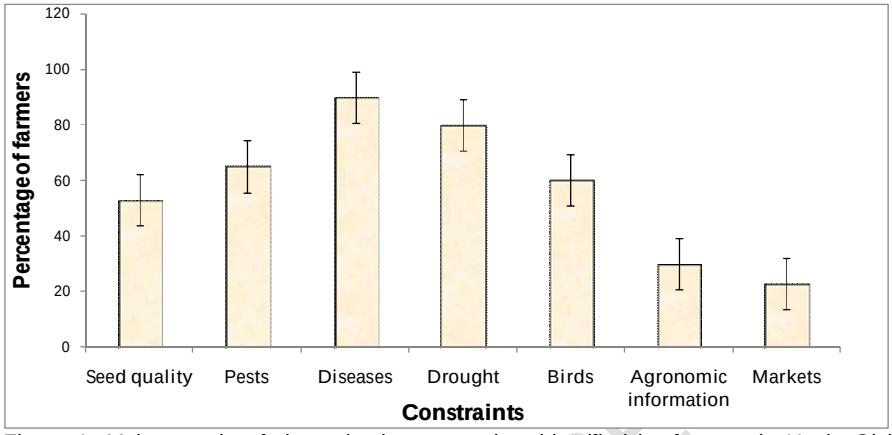

Figure 1: Major passion fruit production constraints identified by farmers in Uasin Gishu County in the year 2017

From the study (Figure 1), seed quality was reported by 53 % of the farmers that it contributes to low yield in passion fruit production. There is limited supply of quality seeds and seedlings since only a few accredited nurseries are available and most of the farmers cannot access good quality planting materials. Majority of farmers produce their own seeds by selecting best fruits from healthy plants from their farms or sourced from the neighbours. Lack of certified seeds and seedlings has led to continuation of cultivar deterioration thus low yield. Farmers also reported that there was limited information available on propagation techniques. To increase the productivity, there should be availability of good planting materials along with proper management practices. The vine can be propagated sexually, through seeds which is the most common practice and asexually by the use of cuttings, layering and grafting.

Majority of the farmers (80%) identified inadequate availability of water as a serious problem affecting plant growth and yield in the region (Figure 2). Substantial proportion of the farmers relied on rain fed farming and had negative impacts on production of the passion fruit as this crop require heavy water demands (10). The deficits of water usually happen during dry episodes from late October to early March which unfavorably affect stomatal aperture of leaves and cell turgidity consequentially decreases both transpiration rates and carbon (IV) oxide assimilation inhibiting leaf metabolism (11; 12) resulting in stunted growth hence low yields.

Pests such as Aphids, whiteflies, mites, leaf miners and thrips were the major pests in most farms and were identified as important contributors of yield loss in passion fruits (9; 13). The pests affect the crop at different growth stages and more significant during flowering. Besides feeding on the plant, these pests also play a role in disease transmission, such as viral diseases specifically passion fruit woodiness (PWD) (14). Birds were identified to cause significant yield during flowering and fruiting by making the flowers and fruits respectively to drop affecting quality and quantity.

Table 2: Major passion fruit production diseases identified by farmers in Uasin Gishu County in the year 2017

Diseases	Anapkoi	Kapseret	Kesses	Moiben	Kesses	Turbo	[a]Mean
PWD	90.4	85.6	89.5	94.1	92.7	88.4	90.1
Collar rot	1.8	2.1	0.6	1.6	0.9	2.2	1.5
Fusarium wilt	3.1	3.6	3.1	1.9	2.5	2.4	2.8
Phytophthora blight	2.5	4.2	4.1	0.8	2.1	2.8	2.8
Scab	0.9	1.8	1.6	1.2	1.4	3.5	1.7
Brown spot	1.3	2.7	1.1	0.4	0.4	0.7	1.1

Diseases was also identified by 90% of the farmers as an important constraint in passion fruit production (Table 2; figure 1). These include PWD virus (locally referred as Kaangumu), Fusarium wilt, Bacterial canker, Septoria Leaf spot, Phytophthora blight and stem-dieback have been reported to be complex and extremely infectious (2; 15; 7). Among the diseases, PWD was the most prevalent mentioned by most farmers as posing as a potential threat to the passion fruit industry in Kenya. The majority of the farmers reported that PWD has subsequently reduced passion fruit orchard life span to less than a year resulting to 100% yield loss. Similar findings were reported by (15) of about 50-100 % loss in passion fruit in Kenya was due to biotic stresses. Some of the factors that influence the extent of loss incurred could be due to the crop susceptibility, virus strain and environmental conditions (16). PWD was mostly pointed as a major cause of farmers quitting passion fruit production since it is hard to manage and once the disease had established the disease would perpetuate indefinitely for a long period of time in an area.

Figure 2: Effects of diseased passion fruits in Uasin Gishu County in the year 2017

Passion fruit is one the crops which is capital intensive at the initial stages. Farmers in Uasin-Gishu reported that lack of information on agronomic practices in passion fruit production was believed to be contributing to the declining yields and related challenges facing the farmers. Apart from the cost of managing the crop, information on passion fruit production practices is limited and farmers chuckle around related information to increase yields.

Marketing is an important aspect in passion fruit production based on the distance between production points and the marketing centres (17). Most of the farmers sell their products in the nearest market where the prices are normally low. These farmers have limited access to higher prices and better markets. In most cases the local markets are often associated with low profit due to low produce prices offered, something that reduces the farm household income levels. Fluctuating prices was also one of the constraints identified by farmers given that it ranged from US $ 0.3 – 1.2per Kilogram (Kg) of fruit.

4. CONCLUSION

Farmers identified passion fruit as the main important economic crop in Uasin-Gishu County despite the constraints facing the production of the crop. Diseases especially PWD was identified to be the most devastating disease affecting passion fruit production was the main cause most farmers have left farming of the crop in the recent years. Understanding of the challenges affecting passion fruit production is important so farmers, researchers, policy makers and extension officers among others looks for possible solutions to address farmers for crop improvement.

REFERENCES

1. Horticultural Crop Development Authority (HCDA). *Horticulture Validated Report 2010. Nairobi* (2011).
2. Mbaka, J., Waiganjo, M., Chege, B., Ndungu, B., Njuguna, J., Wanderi, S., Njoroge, J. and Arim, M. A Survey of the Major Passion Fruit Diseases in Kenya. In *10th KARI biennial scientific conference, Volume 1/Kenya* (2006).
3. Kenya National Beaureu of Statistics (KNBS). *2009 Population and Housing Census* (2010).
4. Government of Kenya (GoK).. *Kenya Open Data. Nairobi: Government of Kenya* (2012).
5. Mwita, A. C., Maina, M., Nyairo, N. M., & Ramasawmy, B. Assessment of profit efficiency among sweet yellow passion fruit farmers in Mbeere south Embu county , Kenya (2016), *27*(3), 4305–4314.
6. Kibet, N. *The Role of Incentives and Drivers in Crop Trade-Off: Evidence from Passion Fruit Uptake in Uasin-Gishu District, Kenya.* Egerton University, Kenya (2011).
7. Gichimu Karani, C., Mwangi, M., & Macharia, I.. Assessment of passion fruit orchard management and farmers ' technical efficiency in Central-Eastern and North-Rift Highlands (2013), *4*(10), 183–191.
8. Ngereza, J., & Pawelzik, E. Constraints and opportunities of organic fruit production in Tanzania (2016), *4*(April), 67–78.
9. Otipa J. M., R.L. Amata, M. Waiganjo, J.G. Mureithi, L.A. Wasilwa, E.M. Ateka, E. Mamati, D. Miano, J. Kinoti, S. Kyamanywa, M. Erbaugh, S. M. Challenges Facing Passion Fruit Smallholder Farmers in North Rift Region of Kenya. *ISHS Acta Horticulturae 911* (2011). Retrieved from 10.17660/ActaHortic.2011.911.37
10. Mwirigi P., M. M. and J. G.-O. Agronomic Management of Yellow Passion Fruit Among Farmers. (2016)., 1–13.
11. Santos, M.G., Ribeiro, R.V., Oliveira, R.F., Machado, E.C., Pimentel, C. The role of inorganic phosphate on photosynthesis recovery of common bean after a mild water deficit. *Plant Science*, (2006). *170*, 659–664.
12. Waseem, M., Ali, A., Tahir, M., Nadeem, M.A., Ayub, M., Tanveer, A., Ahmad, R., Hussain, M. Mechanism of drought tolerance in plant and it management through different methods. *Cont. J. Agric. Sci.*, (2011) *5*, 10–25.
13. Kilalo, D.C, Olubayo, F.M, Ateka, E.M, Hutchinson, J.C. & Kimenju, J. W. Monitoring of Aphid Fauna in Passion fruit Orchards in Kenya. *International Journal of Horticulture and Crop Sci. Res. (IJHCSR* (2013)*)*, *1*, 1–18.
14. Amata, R.L, Otipa, M.J, Waiganjo, M., Wabule, M., Thuranira, E.G, Erbaugh, M. & Miller, S.. Incidences, prevalence and severity of passion fruit fungal diseases in major production regions of Kenya. *Journal of Applied Biosciences* (2009), *20*, 1146–1152.
15. Wangungu, C., Maina, M., Mbaka, J., Kori, N and Gathu, R. Biotic constraints to passion fruit production in central and eastern provinces of Kenya. In *Proceedings of the 2nd RUFORUM Biennial Meeting. Entebbe, Uganda* (2010).
16. Jackson, G.. *Pacific Pests and Pathogens.* Fact Sheet Passion fruit woodiness *(156)* (2016
17. Chains R., H. V. and V. M.. *Mainstreaming Gender Sensitivity in Cash Crop Market Supply. ODA Report* (2009).