

Research Application Summary

**Status of production of Jackfruit (*Artocarpus heterophyllus* Lam.) in Busia County, Kenya**

Ochieng, V.,<sup>1</sup> Wayua, F. O.,<sup>2</sup> Kirigua, V. O.,<sup>3</sup> Gitonga, C. & Wasilwa, L.<sup>3</sup>

Kenya Agricultural and Livestock Research Organisation, Food Crops Research Centre Muguga, Kenya, P. O. Box 30148-00100, Nairobi, Kenya

Kenya Agricultural and Livestock Research Organisation, Non-ruminant Research Institute, P. O. Box 169-50100, Kakamega, Kenya

Kenya Agricultural and Livestock Research Organisation, Headquarters, P. O. Box 57811-00200, Nairobi, Kenya

**Corresponding author:** fwayua@yahoo.co.uk

---

**Abstract**

Jackfruit is one of the underutilised fruits in Kenya which has potential to contribute to food and nutrition security. However, little is known about the status of jackfruit production in the country. This study assessed the status of jackfruit production in Busia County, Kenya. Data were collected through structured interviews with farmers (n=291), traders (n=6), key informant interviews (n=5) and field observations and analysed using descriptive statistics. There were two main varieties of jackfruit - yellow-fleshed and orange-fleshed. Yellow-fleshed jackfruit was grown by 78.0% of the farmers, the mean number of jackfruit trees in the farm being 5 (range: 1 to 30). Orange-fleshed jackfruit was grown by 38.5% of the farmers, the mean number of orange-fleshed jackfruit trees in the farm being 4 (range: 1 to 25). Despite being grown by fewer respondents, orange-fleshed jackfruit was the most preferred, because of sweetness, having less latex, quick maturing and perceived more nutritious. The estimated mean production of jackfruit fruits per year per household was 665±120 (range: 50 to 20,000 fruits). Jackfruit trees were mainly used as a source of food (42.5%), income (22.3%) and shade (18.9%). Other uses included manure (from the leaves), firewood / charcoal, livestock feed and timber. The trees were grown in pure stands (45.4%), along the hedge (29.5%), and intercropped with other crops (15.0%). Only 13.1% of farmers had access to information on jackfruit production. The main sources of information were fellow farmers (52.2%), indigenous knowledge (21.7%), traders (8.7%) and Ministry of Agriculture extension (7.2%). The main types of information were on seedling production and nursery management. Appropriate strategies are needed to enhance commercialisation of the fruit and its contribution to livelihoods of rural communities. Such strategies include awareness creation on the economic and nutritional importance of the fruit, developing a viable seed system, capacity building of farmers on good agricultural practices, and promotion of value added products.

**Key words:** *Artocarpus heterophyllus*, food security, Kenya, nutrition, underutilised fruit

## Résumé

Le jacquier est l'un des fruits sous-utilisés au Kenya qui a le potentiel de contribuer à la sécurité alimentaire et nutritionnelle. Cependant, on en sait peu sur l'état de la production de jacquiers dans le pays. Cette étude a évalué l'état de la production de jacquier dans le comté de Busia, au Kenya. Les données ont été collectées à travers des entretiens structurés avec des agriculteurs (n = 291), des commerçants (n = 6), des entretiens avec des informateurs clés (n = 5) et des observations sur le terrain et analysées à l'aide de statistiques descriptives. Il y avait deux principales variétés de jacquier - à chair jaune et à chair orange. Le jacquier à chair jaune était cultivé par 78,0% des agriculteurs, le nombre moyen de jacquiers dans l'exploitation étant de 5 (fourchette: 1 à 30). Le jacquier à chair orange était cultivé par 38,5% des agriculteurs, le nombre moyen de jacquiers à chair orange dans l'exploitation étant de 4 (fourchette: 1 à 25). Bien qu'il ait été cultivé par moins de répondants, le jacquier à chair orange était le plus préféré, en raison de sa douceur, de son moins de latex, de sa maturation rapide et de son apparence plus nutritive. La production moyenne estimée de jacquiers par an et par ménage était de  $665 \pm 120$  (fourchette: 50 à 20 000 fruits). Le jacquier était principalement utilisé comme source de nourriture (42,5%), de revenu (22,3%) et d'ombre (18,9%). Les autres utilisations comprenaient le fumier (des feuilles), le bois de chauffage / charbon de bois, l'alimentation du bétail et le bois. Les arbres étaient cultivés en peuplements purs (45,4%), le long de la haie (29,5%), et intercalés avec d'autres cultures (15,0%). Seuls 13,1% des agriculteurs avaient accès à des informations sur la production de jacquiers. Les principales sources d'information étaient les autres agriculteurs (52,2%), les savoirs autochtones (21,7%), les commerçants (8,7%) et la vulgarisation du ministère de l'Agriculture (7,2%). Les principaux types d'informations concernaient la production de plants et la gestion des pépinières. Des stratégies appropriées sont nécessaires pour améliorer la commercialisation du fruit et sa contribution aux moyens de subsistance des communautés rurales. Ces stratégies comprennent la sensibilisation à l'importance économique et nutritionnelle des fruits, le développement d'un système semencier viable, le renforcement des capacités des agriculteurs sur les bonnes pratiques agricoles et la promotion de produits à valeur ajoutée.

Mots-clés: *Artocarpus heterophyllus*, sécurité alimentaire, nutrition, Kenya, fruits sous-utilisés

---

## Introduction

Jackfruit (*Artocarpus heterophyllus* Lam.) is an important crop for rural communities because of its environmental resilience. The fruit contains high nutritional and medicinal properties (Swami *et al.*, 2012; Ubi *et al.*, 2016). However, despite all these merits, jackfruit has remained one of the most underutilised fruits in Kenya and in many parts of Africa. Jackfruit is a common crop in Busia County of Western Kenya. However, research and development initiatives to create a favourable framework for its commercialisation is limited. Existing documentation on jackfruit production is scattered, unreliable and inconsistent, making it difficult to justify development of improvement programmes. Little is known about the status of production and commercialisation of the crop. This study was done to collect baseline data on the status of jackfruit production in Busia County, Kenya. Understanding these parameters will facilitate designing of appropriate strategies to enhance contribution of jackfruit to food security and

livelihoods of rural communities, especially the poorer households. This is part of interrelated studies with objectives that will inform introduction, promotion and commercialisation of underutilised fruits in Kenya, with proven benefits for human nutrition and health.

### Materials and Methods

**Study Area.** The study was conducted in six out of the seven sub-counties of Busia County, Kenya (Table 1).

**Table 1. Study sites and interviewed respondents in Busia County, Kenya**

Sub-county	Ward	Males	Females	Total No. of respondents
Butula	Marachi North	6	5	11
	Marachi East	1	5	6
	Lugulu	2	1	3
	Total	9	11	20
Matayos	Matayos South	11	7	18
	Bukhayo West	34	31	65
	Mundika	1	1	1
	Mayenje	4	14	18
	Total	50	53	103
Nambale	Nalatsi North	11	5	16
	Khwirare / Tangakona	1	0	1
	Kisoko	1	0	1
	Nambale Township	9	9	13
	Total	17	14	31
Samia	Agenga / Nanguba	10	11	21
	Bwiri	5	8	13
	Nangina	10	8	18
	Namboboto / Nambuka	10	4	14
	Total	35	31	66
Teso North	Angurai South	1	0	1
	Angurai North	1	0	1
	Malaba South	10	12	22
	Akudiet	0	2	2
	Malaba Central	3	0	3
	Amukura East	3	3	6
	Total	19	16	35
Teso South	Amukura East	11	10	21
	Angoromo	11	4	15
	Total	22	14	36

**Data collection.** Data were collected through structured interviews with jackfruit farmers (n=291), traders (n=6), key informant interviews (n=5) and field observations (Table 2). Key informants included Agricultural Officers, prominent traders of jackfruit, and village elders. Sites visited and observed included farms where jackfruit trees were grown (to observe varieties grown, size of the trees, disease infestations, etc.).

**Table 2. Sample size for household interviews with jackfruit farmers in Busia County, Kenya**

Sub-county	Male	Female	Total
Butula	9	11	20
Matayos	50	53	103
Nambale	17	14	31
Samia	35	31	66
Teso North	19	16	35
Teso South	22	14	36
Total	152	139	291

**Sampling for household interviews.** The six sub-counties were randomly selected. Within sub-counties, purposive sampling was used to identify farmers with jackfruit trees to be interviewed. This was done with the assistance of key informants (local leaders, and agriculture extension staff). The household head or spouse, or the person most commonly responsible for preparing food or making food purchases, was interviewed using a structured questionnaire. Quantitative data from the household interviews were triangulated through key informant interviews and field observations.

**Data analysis.** Descriptive statistics (frequencies, means, percentages and totals) were used to describe quantitative data from the household survey—continuous and categorical variables being reported as mean±standard errors and percent (%), respectively. All analyses were done in SPSS Statistics Version 20 (IBM Corporation, SPSS Statistics Release 20.0.0; USA) and MS-Excel 2013 for Windows (Microsoft Corporation, USA). Qualitative data from key informant interviews and field observations were summarised into thematic components and written into descriptive prose. The results are presented using tables, graphs and narratives.

## Results and Discussions

**Jackfruit production.** The estimated mean production of jackfruit fruits per year per household was 665±120 fruits (range: 50 to 20,000 fruits) (Table 3).

**Types of jackfruit grown.** There were two main varieties of jackfruit grown in the area—yellow-fleshed and orange-fleshed. Orange-fleshed jackfruit was grown by 38.5% of respondents, and yellow-fleshed jackfruit was grown by 78.0% of the respondents. The main reason for growing the different jackfruits was because these were the only available varieties at the time of planting, and that both varieties were sweet and produced bigger fruit which was fleshy (Table 4). Though rare, orange-fleshed jackfruit was superior in preference parameters than yellow fleshed jackfruit. For example, it was superior in terms of sweetness, having less latex, quick maturing, and perceived to be more nutritious in terms of vitamin A, and most of the preference parameters mentioned by farmers (Table 4). Some varieties just grew on their own and farmers reported not having any reasons for preferring them.

Table 3. Jackfruit production in Busia County, Kenya

		Butula (N=20)*	Matayos (N=103)	Nambale (N=31)	Samia (N=66)	Teso North (N=35)	Teso South (N=36)	Overall sample (N=291)
Categorical variables	Category	Percent	Percent	Percent	Percent	Percent	Percent	Percent
No. of jackfruit trees in the farm (No.)	Orange fleshed	2.0±0.4 (range 1-3)	4.5±0.6 (range: 1- 25)	0	2.7±0.4 (range: 1-10)	2.5±0.9 (range: 1- 5)	3.0±0.4 (range: 1-4)	3.7±0.4 (range: 1-25)
	Yellow fleshed	6.0±1.7 (range1-30)	5.0±0.7 (range: 1-21)	5.3±0.9 (range: 1-25)	3.7±0.5 (range: 1-11)	3.9±0.5 (range 1-10)	3.4±0.5 (range: 1-12)	4.5±0.3 (range: 1-30)
How jackfruit trees were acquired (%)	Planted by respondent	55.0 (11)	83.2 (89)	100.0 (31)	81.4 (57)	91.7 (33)	78.1 (25)	83.1 (246)
	Inherited	25.0 (5)	5.6 (6)	-	12.9 (9)	5.6 (2)	15.6 (5)	9.1 (27)
	Grew on their own	20.0 (4)	11.2 (12)	-	5.7 (4)	2.8 (1)	6.3 (2)	7.8 (23)
If planted, those applying inputs (%)	Yes	41.7 (5)	51.7 (46)	12.9 (4)	63.8 (37)	30.3 (10)	71.4 (15)	48.0
Estimated production of jackfruit fruits per year per household (No.)	No.	771±397 (range: 60 to 6,000)	1,135±340 (range: 60 to 20,000)	474±133 (range: 60 to 2,500)	263±30 (range: 50 to 1000)	412±77 (range: 60 to 1720)	647±252 (range: 50 to 5,760)	665±120 (range: 50 to 20,000)
Challenges in production of jackfruit (%)	Rotting of fruits	15.0 (3)	15.7 (16)	-	25.8 (17)	5.7 (2)	13.9 (5)	14.8 (43)
	Pests and diseases	-	12.6 (13)	-	-	25.7 (9)	2.8 (1)	13.1 (38)
	Premature falling of fruits	20.0 (1)	6.8 (7)	3.2 (1)	12.1 (8)	8.6 (3)	8.3 (3)	8.9 (26)
	Theft	10.0 (2)	13.6 (14)	-	9.1 (6)	-	-	7.6 (22)
	Drought	5.0 (1)	8.7 (9)	3.2 (1)	12.1 (8)	-	2.8 (1)	6.9 (20)
	Long duration before fruit production	-	4.9 (5)	3.2 (1)	7.6 (5)	-	5.6 (2)	4.5 (13)
	Too many leaves	-	7.8 (8)	-	1.5 (1)	-	2.8 (1)	3.4 (10)

Variable fruit sizes	35.0 (7)	-	-	3.0 (2)	-	-	3.1 (9)
Lack of space occupied by jackfruit	-	-	-	-	2.9 (1)	16.7 (6)	2.4 (7)
Less fruits which are not sweet	-	1.9 (2)	-	3.0 (2)	8.6 (3)	-	2.4 (7)
Lack of knowledge on production	-	-	-	6.1 (4)	2.9 (1)	8.3 (3)	2.4 (7)
Lack of market	-	-	-	10.6 (7)	-	-	2.4 (7)
Unsuccessful propagation from seeds	5.0 (1)	1.0 (1)	-	4.5 (3)	-	2.8 (1)	2.1 (6)
Fruit cracking while still young	-	2.9 (3)	-	3.0 (2)	-	-	1.7 (5)
Lack of inputs	-	1.9 (2)	-	3.0 (2)	-	-	1.4 (4)
Stunted growth	-	1.0 (1)	-	1.5 (1)	-	-	0.7 (2)
Lack of knowledge on best varieties	-	-	-	-	-	2.8 (1)	0.7 (2)
Poor quality seeds	-	1.0 (1)	-	1.5 (1)	-	-	0.7 (2)
Difficulty in harvesting (climbing the tree)	-	1.9 (2)	-	-	-	-	0.7 (2)
Livestock eating the seedlings	-	-	-	1.5 (1)	-	-	0.3 (1)
Strong smell	-	1.0 (1)	-	-	-	-	0.3 (1)

\*N = number of respondents per sub-county

\*\* Figures in parentheses represent number of farmers who responded

\*\*\* Dash (-) means no data

**Table 4. Reasons for preference of different jackfruit varieties (in terms of flesh colour)**

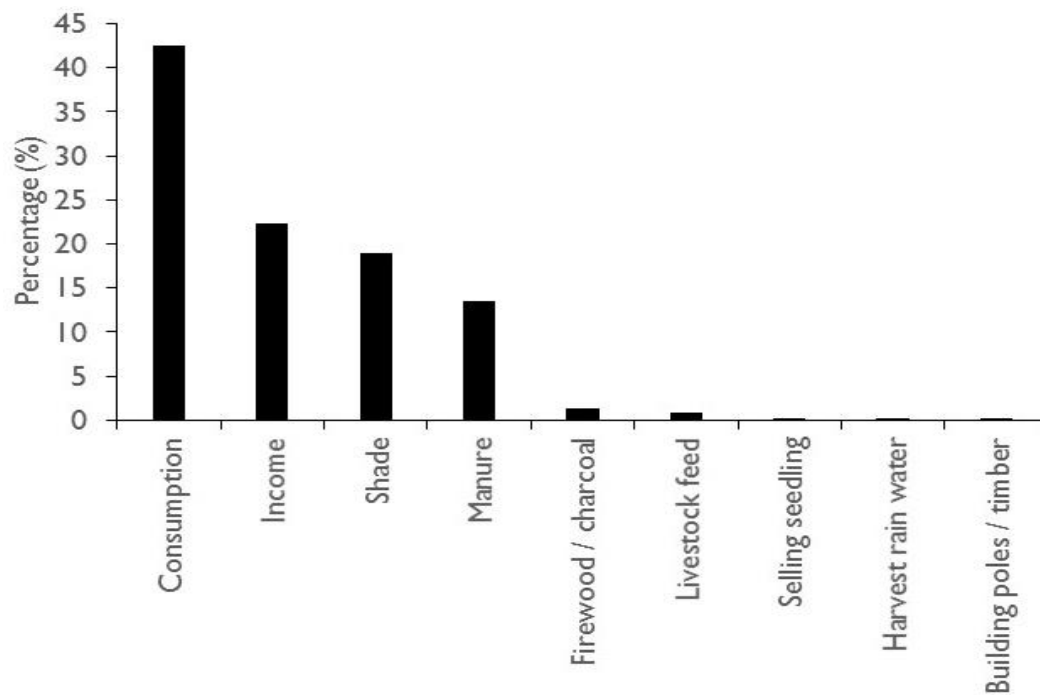
Reasons for preference of jackfruit variety	Orange fleshed		Yellow fleshed	
	N*	%	N	%
Has a sweet taste, hence appetising to eat	73	42.9	151	44.3
Was the only available variety at the time	25	14.6	49	14.4
Produces bigger fruit which are fleshy	26	15.3	71	20.8
Has less latex	9	5.3	2	0.6
Quick maturing	8	4.7	6	1.8
Highly nutritious (contains Vitamin A)	7	4.1	2	0.6
Has more yield per season	5	2.9	8	2.3
Low sugar content	5	2.9	1	0.3
Juicy	2	1.2	10	2.9
Has good appealing colour	2	1.2	1	0.3
Is most liked by family members	2	1.2	5	1.5
Is the one demanded by customers	2	1.2	5	1.5
Crunchy	2	1.2	2	0.6
Produces fruit twice per year	1	0.6	-	-
Does not have strong smell when ripe	1	0.6	1	0.3
Farmer did not have any reason for growing it	-**	-	11	3.2
Farmers was advised that it was good for agriculture	-	-	6	1.8
Most people have planted this variety	-	-	2	0.6
Provides good shade	-	-	2	0.6
Produces fruit once a year	-	-	1	0.3
Easy management	-	-	1	0.3
Serves as food during hunger times	-	-	4	1.2
Total	170	100.0	341	100.0

\*N indicates number of households that responded; \*\* Dash (-) means no data

**Uses of Jackfruit trees.** The main reasons of having jackfruit trees in the County was a source of food for domestic consumption (42.5%), income generation (22.3%) and shade (18.9%) (Figure 1). Other uses of jackfruit trees included manure (from the leaves), firewood / charcoal, livestock feed and building poles /timber.

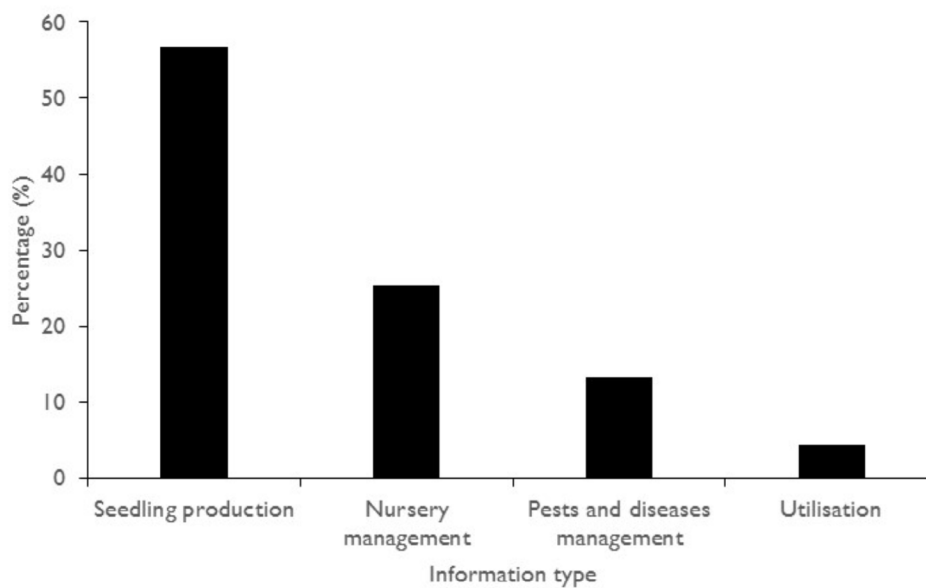
**How the Jackfruits are grown.** Jackfruit were grown in pure stands (45.4%), along the hedge (29.5%), intercropped (15.0%), and scattered in the compound. Intercropping was done with legumes, bananas, maize, mangoes, blue gum, sugarcane and cassava.

Almost half (48.0%) of the respondents who planted jackfruits applied inputs—the main types of inputs being manure, seeds / seedlings, fertiliser and protecting the seedlings after planting (Figure 2).



**Figure 2.** Types of inputs applied to jackfruit seedlings and trees

**Access to information on production.** Only 13.1% of farmers had access to information on jackfruit production. The main sources of information were fellow farmers (52.2%), Indigenous Technical Knowledge (21.7%), traders (8.7%) and Ministry of Agriculture extension (7.2%). The main types of information were on seedling production and nursery management (Fig. 4).



**Figure 4.** Types of information on jackfruit production available to farmers in Busia County, Kenya



**Constraints in production of Jackfruit.** Over half of the farmers (i.e., 56.0%) reported experiencing constraints in production of jackfruit. The main constraints included rotting of fruits, pests and diseases, and premature falling of fruits. Other constraints included theft, drought, long duration before fruit production, too many leaves, and lack of space as the tree develops a very large canopy). The leaves were reported to make compounds dirty. Attempt to use leaves for compost manure do not yield good results as they do not decompose easily. Theft was avoided by growing the jackfruits within the homestead. Land sharing was also a major constraint in jackfruit production.

### **Conclusions**

The study has shown that jackfruit is a significant crop in Busia County, Kenya. In-depth understanding of the status of production of jackfruit will help to devise appropriate strategies that would enhance commercialisation of the fruit and its contribution to food security and livelihoods of rural communities. Such strategies should include deliberate campaigns and awareness creation on the economic and nutritional importance of the fruit, developing a viable seed system, capacity building of farmers on good agricultural practices (GAP), and development and promotion of value added products.

### **Acknowledgements**

This study was funded by USAID through Feed the Future (FtF) Integrated Agricultural Research and Development (IARD) project. Sincere gratitude to the households in Busia County for their participation. This paper is a contribution to the 2018 Sixth African Higher Education Week and RUFORUM Biennial Conference.

### **References**

- Ubi, G. M., Jemide, J. O., Ebri, M. N., William, U. and Essien, I. S. 2016. Assessment of phenological variability and nutritional value of the underutilised tropical Jackfruit *Artocarpus heterophyllus* Frost. in Nigeria. *Journal of Advances in Biology and Biotechnology* 6 (3): 1-17.
- Swami, S., B., Thakor, N., J., Haldankar, P. M. and Kalse, S. B. 2012. Jackfruit and its many functional components as related to human health. A review. *Comprehensive Reviews in Food Science and Food Safety* 11: 565-576.