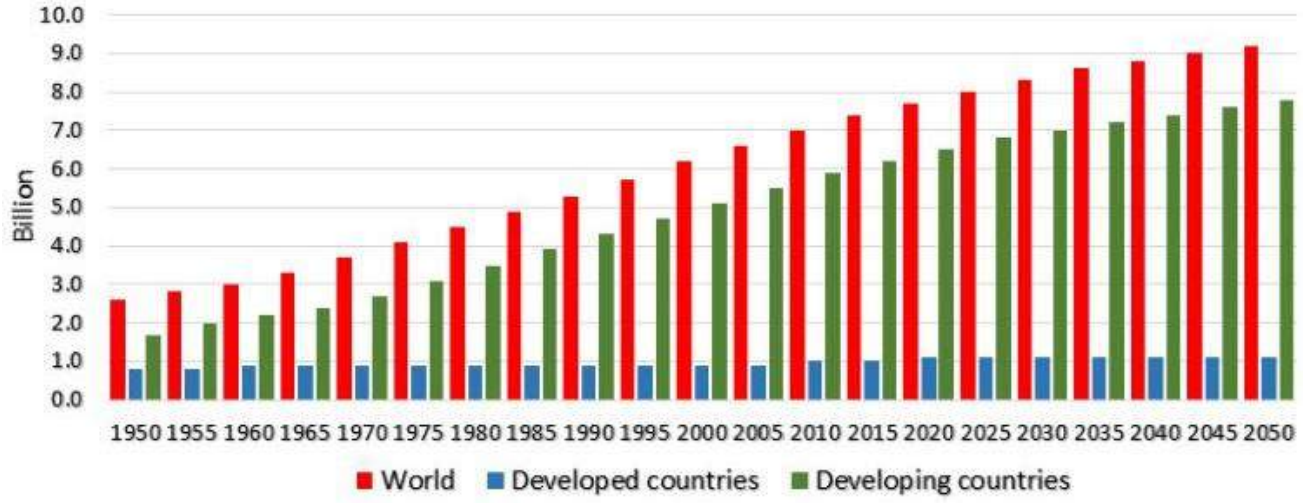
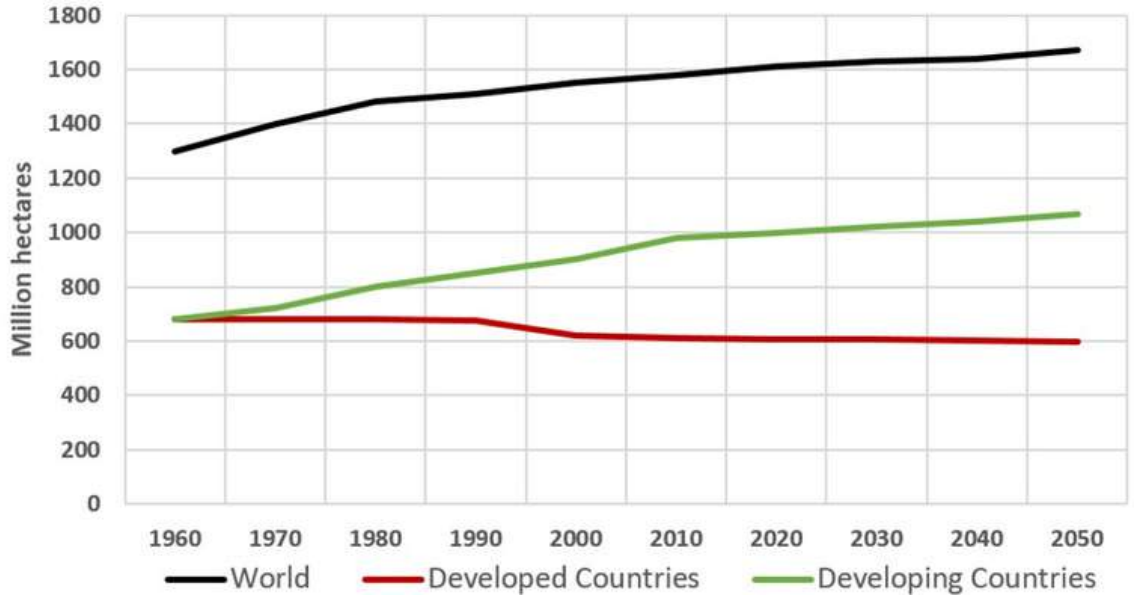
Commercialising Black Soldier Fly farming for livestock feed and organic waste recycling into biofertilizer in Tororo and Soroti

James Peter Egonyu, PhD
Assoc. Prof. Agriculture/Entomology (PhD Agricultural Entomology, University of Nairobi; MSc Crop Science and BSc Agriculture, Makerere University)
Dean-Faculty of Agriculture and Animal Sciences,Busitema University
P. O. Box 203, Soroti, Uganda
Emails:Jegonyu.sci@busitema.ac.ugandJpegonyu@gmail.com
Mobile: +256 (0) 772 464766
Website:www.busitema.ac.ug

World Population & Food Security Outlook

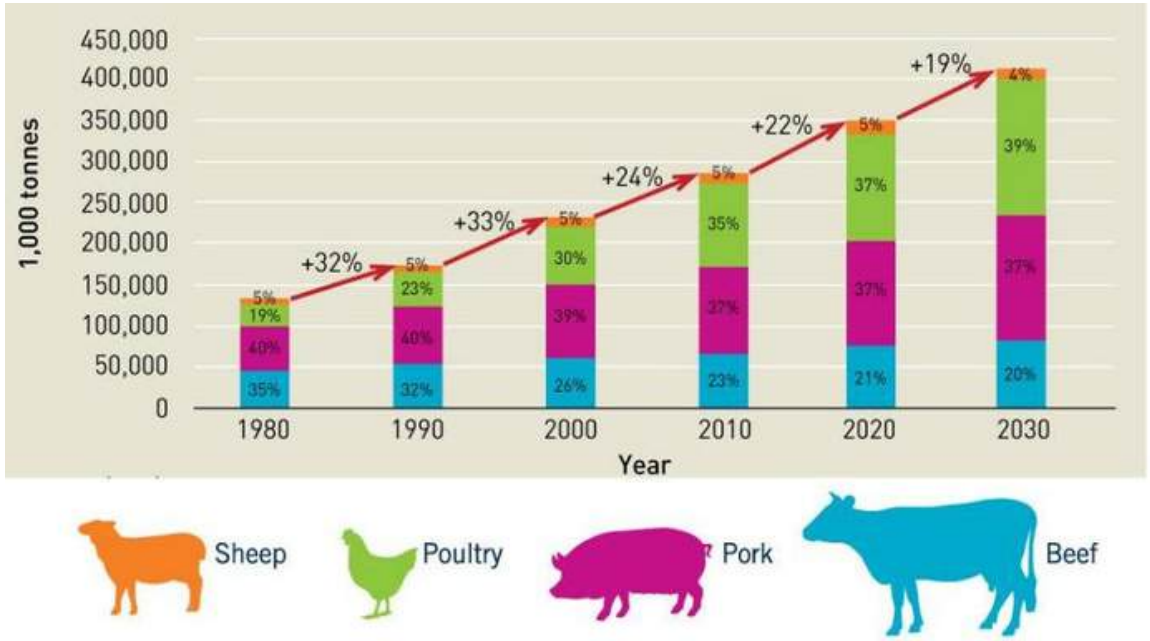


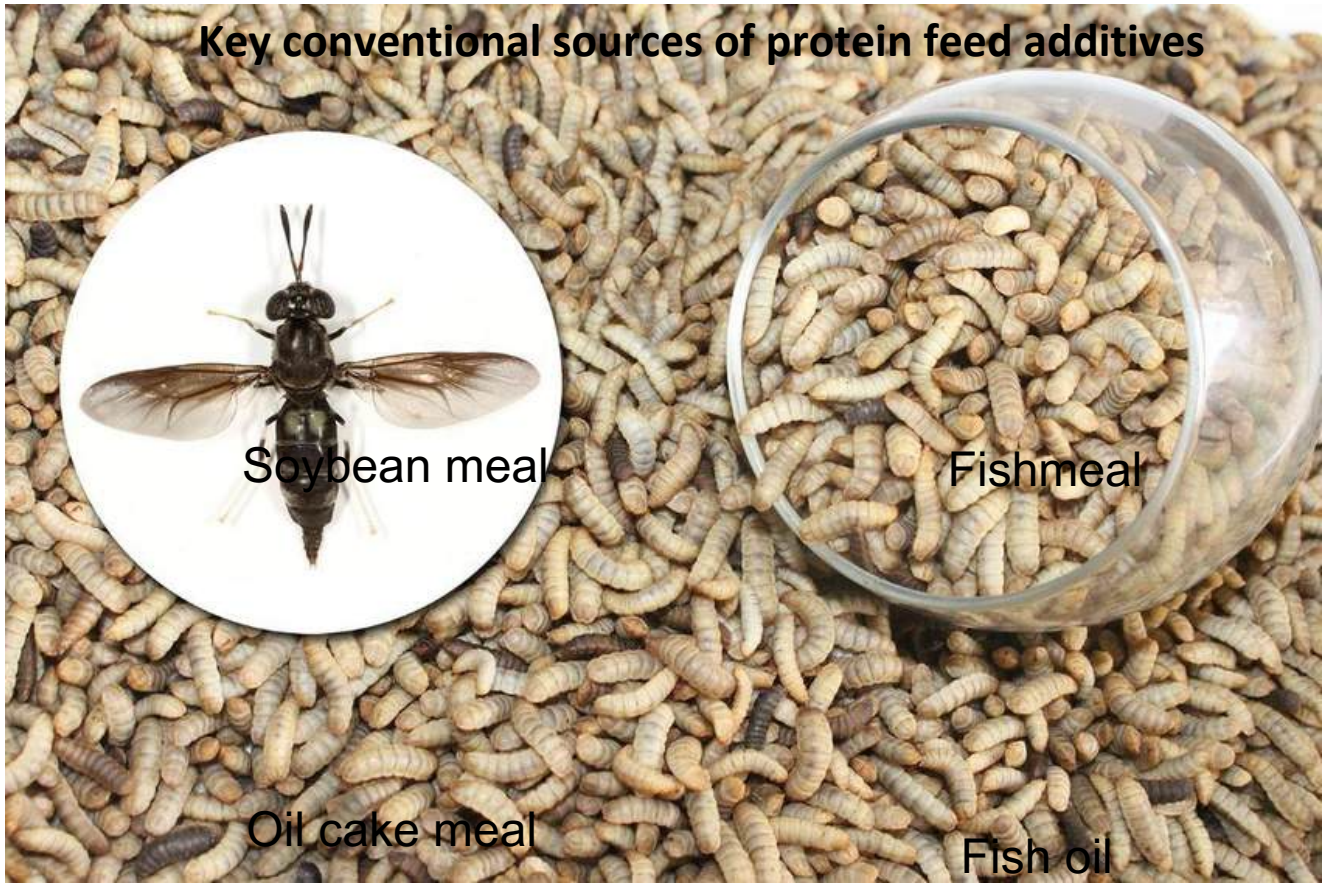


- 690 million hungry–rising by 12 m annually.
- 144 m children <5 years stunted, 47 million wasted & 38 m overweight.
- COVID-19 added 83-132 m to undernourished people in 2020.
- Climate change
- 50% more food needed by 2050
- New ways of coping with global food & nutritional security highly needed

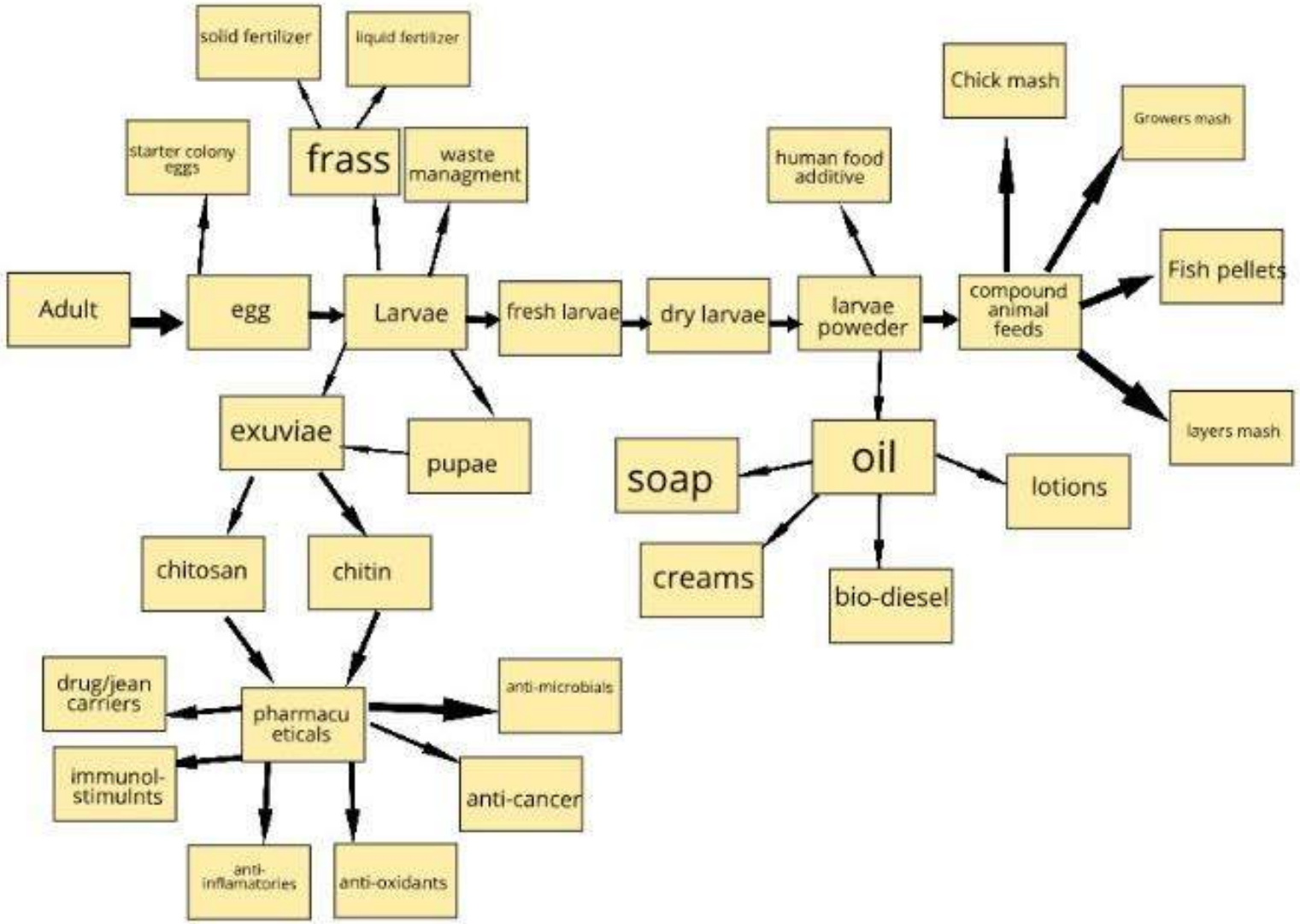
FAO 2020: http://www.fao.org/3/ca9692en/online/ca9692en.html; UNDP 2020 https://hdr.undp.org/en/2020-report ; Schneider 2020.https://bit.ly/37r7OHN ; Silva2018:https://www.canr.msu.edu/news/feeding-the-world-in-2050-and-beyond-part-1

Protein for animal and human feed





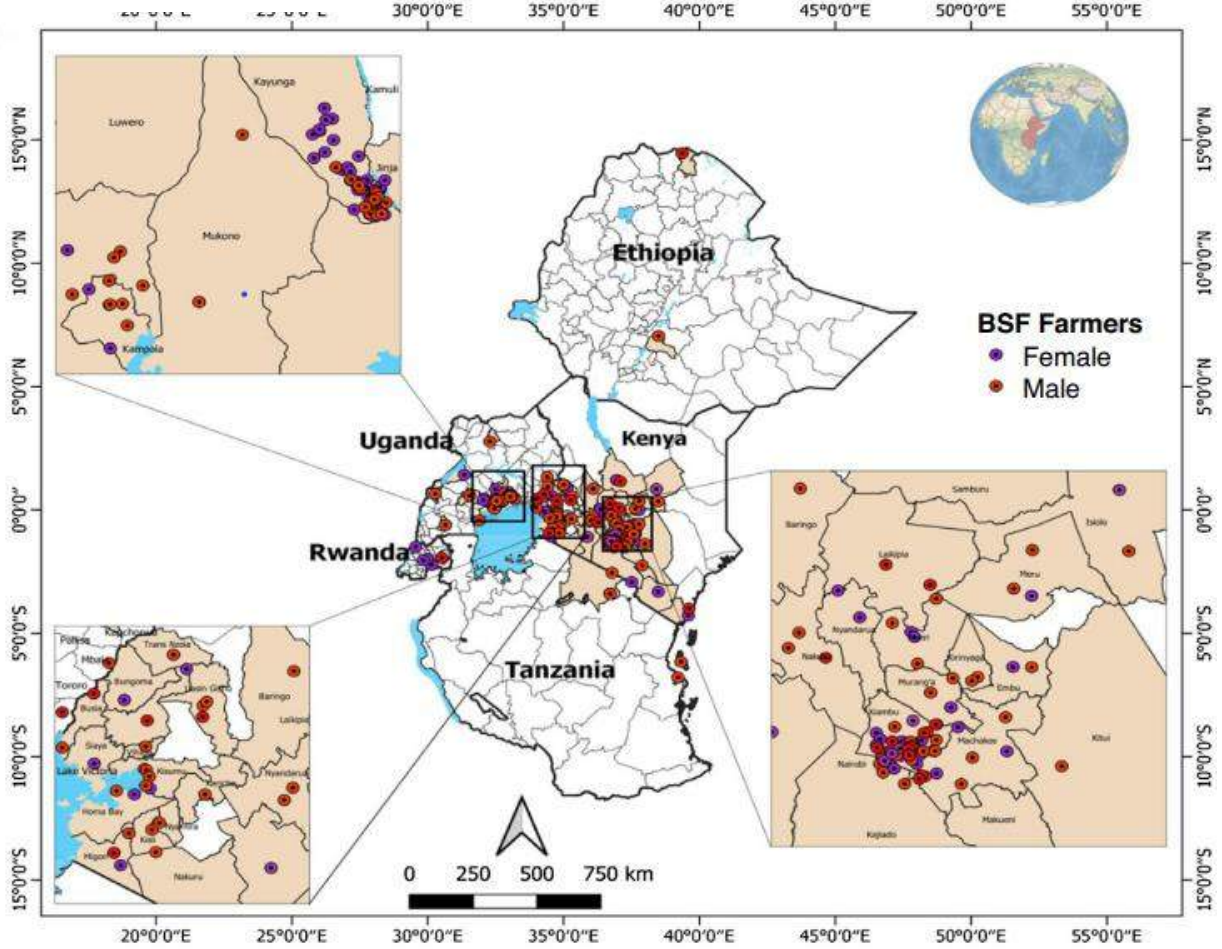
BSF value chain anaylysis

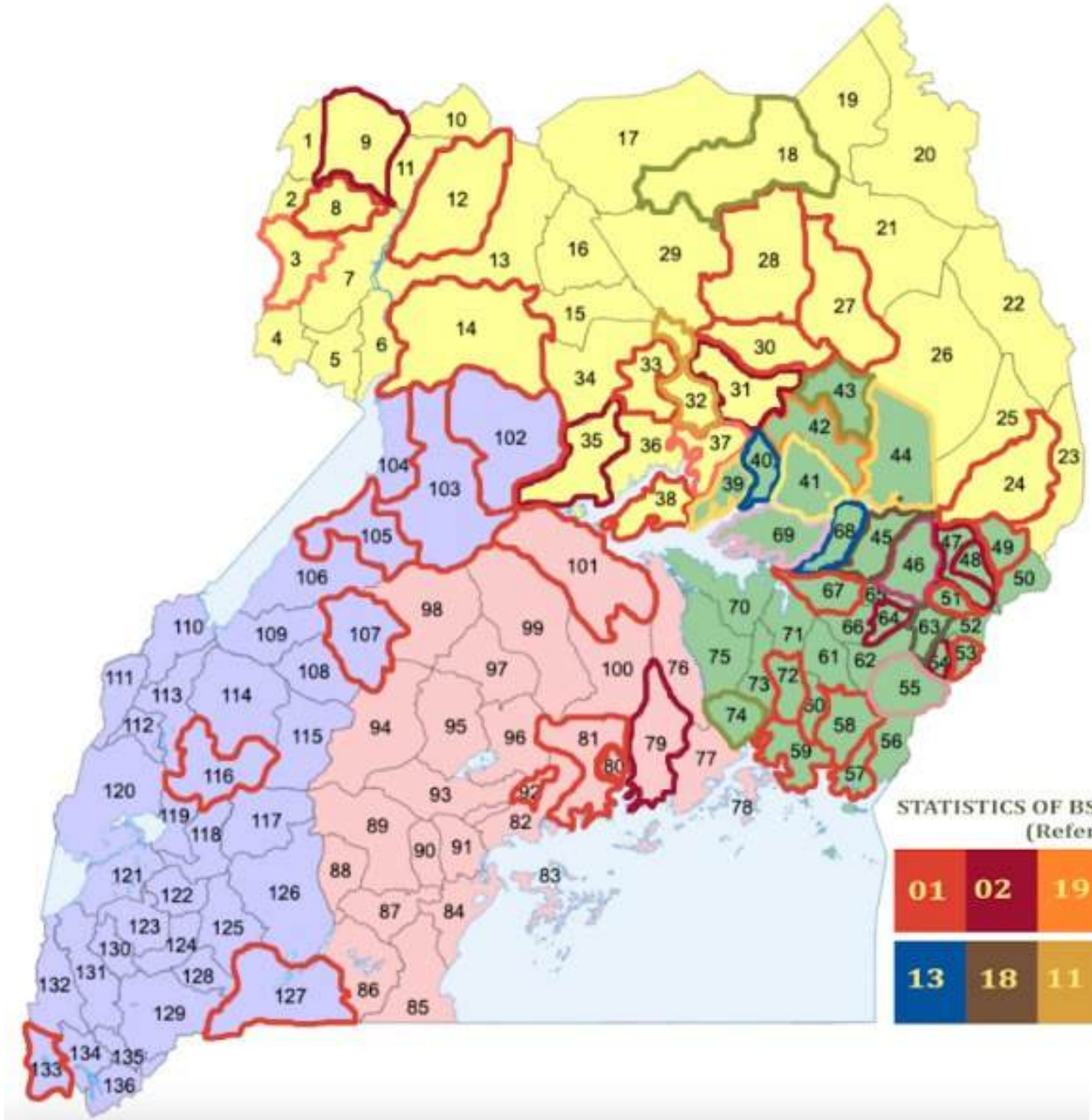


Available online at www.sciencedirect.com
ScienceDirect
Current Opinion in Insect Science

Edible insect farming as an emerging and profitable enterprise in East Africa

Chrysantus M Tanga, James P Egonyu,
Dennis Beesigamukama, Saliou Niassy, Kimathi Emily,
Henlay JO Magara, Evanson R Omuse,
Sevgan Subramanian and Sunday Ekesi





STATISTICS OF BSF FARMERS PER DISTRICT
(Refer to Color Code)

01	02	19	03	12	04	17
13	18	11	05	24	38	35

1	Koboko	47	Bulambuli	93	Gomba
2	Maracha	48	Kapchorwa	94	Mubende
3	Arua	49	Kween	95	Kasanda
4	Zombo	50	Bukwo	96	Mityana
5	Nebbi	51	Sironko	97	Kiboga
6	Pakwach	52	Bududa	98	Kyankwanzi
7	Madi Okollo	53	Namisindwa	99	Nakaseke
8	Terego	54	Manafwa	100	Luwero
9	Yumbe	55	Tororo	101	Nakasongola
10	Moyo	56	Busia	102	Kiryandongo
11	Obongi	57	Namayingo	103	Masindi
12	Adjumani	58	Bugiri	104	Buliisa
13	Amuru	59	Mayuge	105	Hoima
14	Nwoya	60	Bugweri	106	Kikuube
15	Omoro	61	Namutumba	107	Kakumiro
16	Gulu	62	Butaleja	108	Kibaale
17	Lamwo	63	Mbale	109	Kagadi
18	Kitgum	64	Budaka	110	Ntoroko
19	Karenga	65	Butebo	111	Bundibugyo
20	Kaabong	66	Kibuku	112	Bunyangabu
21	Kotido	67	Pallisa	113	Kabarole
22	Moroto	68	Ngora	114	Kyenjojo
23	Amudat	69	Serere	115	Kyegegwa
24	Nakapiripirit	70	Buyende	116	Kamwenge
25	Nabilatuk	71	Kaliro	117	Kazo
26	Napak	72	Iganga	118	Ibanda
27	Abim	73	Luuka	119	Kitagwenda
28	Agago	74	Jinja	120	Kasese
29	Pader	75	Kamuli	121	Rubirizi
30	Otuke	76	Kayunga	122	Buhweju
31	Alebtong	77	Buikwe	123	Bushenyi
32	Lira	78	Buvuma	124	Sheema
33	Kole	79	Mukono	125	Mbarara
34	Oyam	80	Kampala	126	Kiruhura
35	Apac	81	Wakiso	127	Isingiro
36	Kwania	82	Mpigi	128	Rwampara
37	Dokolo	83	Kalangala	129	Ntungamo
38	Amolatar	84	Masaka	130	Mitooma
39	Kaberamaido	85	Kyotera	131	Rukungiri
40	Kalaki	86	Rakai	132	Kanungu
41	Soroti	87	Lwengo	133	Kisoro
42	Amuria	88	Lyantonde	134	Rubanda
43	Kapelebyong	89	Sembabule	135	Rukiga
44	Katakwi	90	Bukomansimbi	136	Kabale
45	Kumi	91	Kalungu		
46	Bukedea	92	Butambala		

Standards on use of insect as food and feed


UGANDA STANDARD

US 1712

First Edition 2017-06-20

Dried insect products for compounding animal feeds — Specification

COMPLIMENTARY COPY

Reference number US 1712: 2017

© UNBS 2017


KENYA STANDARD

KS 2711:2017

ICS 65.120

Dried insect products for compounding animal feeds — Specification

© KEBS 2017

First Edition 2017


RSB Rwanda Standards Board

RWANDA STANDARD

DRS 485

First edition

2021-mm-dd

Production and handling of edible insects for food and feed — Code of practice

Copy for public review

ICS 65.120

Reference number DRS 485: 2021

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European Commission

Food, Farming, Fisheries

Food Safety

Approval of fourth insect as a Novel Food

Questions and answers

A selection of questions and answers compiled through the approval process.

What was adopted by the Commission in January 2023?

The Commission has authorised the placing on the market of a fourth insect, *Alphitobius diaperinus* (lesser mealworm), as a food.

The term 'lesser mealworm' refers to the larval form of *Alphitobius diaperinus*, an insect species that belongs to the family of Tenebrionidae (darkling beetles).

The novel food consists of the frozen, paste, dried and powder forms of house cricket. It is intended to be marketed as a food ingredient in a number of food products for the general population.

In addition, the Commission has authorised for the first time the placing on the market of partially defatted powder obtained from whole *Acheta domesticus* (house cricket), as a novel food.

The authorisation of these two novel foods will allow the applicants to place this insect species on the EU market under certain conditions of use.

- Migratory locust ***(Locusta migratoria)***
- Yellow mealworm ***(Tenebrio molitor)***
- house cricket ***(Acheta domesticus)***
- lesser mealworm (*Alphitobius diaperinus*)

Expected Outputs

1. Pilot facility for BSF larvae rearing and training of potential adopters established at FSE.
2. At least 360 farmers trained in the establishment of BSF-based enterprises.
3. Three professional staff trained with competence and four labourers and 2 undergraduate volunteers engaged in project implementation in the BSF facility.
4. BSF-based poultry feed formulated and evaluated, ready for commercialisation.
5. BSF frassfertilizer processed, evaluated and packaged for commercialisation.
6. New knowledge on the performance of BSF under local conditions and locally available substrates; and performance of BSF-based poultry feed generated and published
7. At least one product, either biofertilizer or animal feed registered with UNBS and URSB.

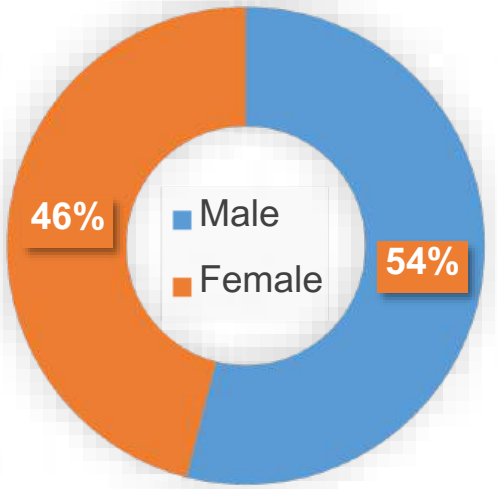
Key infrastructural establishments

Newly built rearing unit at Nagongera

Renovated rearing unit at Arapai

Waste shredder at Nagongera & Arapai

289 Farmers trained, with four adopters



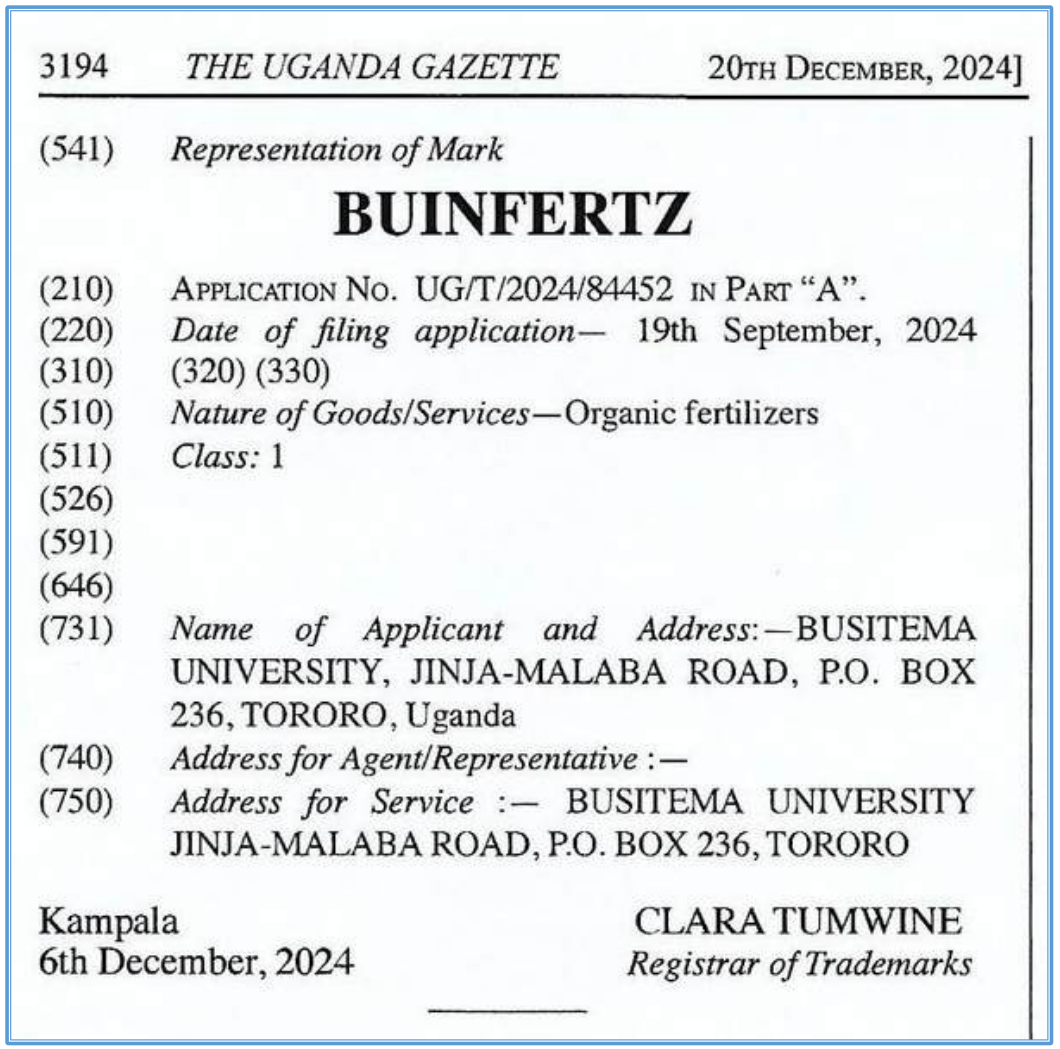
54 districts across Uganda

Students research

Name	Programme	Topic	Progress
Okiror Isaac	BSc Agriculture	Effect of waste type on nutritional composition of Fertilizer from Market Food Waste & Local Brewers Spent Grain	Graduated during the 15th Graduation ceremony of Busitema University on 29thNovember 2024
Asiandu Lawrence	BSc Agriculture	Effect of Black Solider Fly Frass Fertilizer from Market Food Waste and Local Brewers Spent Grain on Growth of Amaranthus	
Anuso Sarah	BSc Agriculture	Recycling Market Food Waste & Local Brewers Spent Grain into Animal Protein Feed	Set for the next graduation of the university
Loyo Morag Peace	BSc	Influence of BSFL formulated feeds on the growth of broiler chicken	Pre-starterfeedsandstarterPellets where prepared from Katerema B Tororo feed processing plant. Sixty broiler chicks procured for the trial.
Masereka Ronald	BSc	Evaluate performance of BSF frass bio fertilizer on Sukuma Wiki)	Finalizing data collection.

2 professional staff and 5 students trained

Product Development



3194 *THE UGANDA GAZETTE* 20TH DECEMBER, 2024]

(541) *Representation of Mark*

BUINFERTZ

(210) APPLICATION NO. UG/T/2024/84452 IN PART "A".
(220) *Date of filing application*— 19th September, 2024
(310) (320) (330)
(510) *Nature of Goods/Services*—Organic fertilizers
(511) *Class:* 1
(526)
(591)
(646)
(731) *Name of Applicant and Address*:—BUSITEMA UNIVERSITY, JINJA-MALABA ROAD, P.O. BOX 236, TORORO, Uganda
(740) *Address for Agent/Representative* :—
(750) *Address for Service* :— BUSITEMA UNIVERSITY JINJA-MALABA ROAD, P.O. BOX 236, TORORO

Kampala
6th December, 2024

CLARA TUMWINE
Registrar of Trademarks

- At 12 months ~400 kg of dry frass fertilizer & 80 kg of dry larvae

Evaluating the performance of larvae on locally available substrates&its frassfertilizeronvegetable growth

Performance of BSFL on different waste substrates

Parameter	Substrate				$F_{(3,12)}$	P
	MW	MG	MW+MG	WB		
Larval growth rate	0.0010±0.0002a	0.0007±0.0003a	0.0012±0.0002a	0.0003±0.0001a	21394122	0.07
Larval weight gain	103±3.5ab	119.3±13.4b	**76.3±4.6a**	136.3±8.0b	21388699	0
Survival rate (%)	80.3±0.6a	79.7±2.1a	80.9±1.0a	**48.5±2.8b**	73.34	0
Substrate reduction percentage	66.7±2.2a	64.9±1.8a	72.4±2.3a	**51.8±2.8b**	14.42	0
Waste reduction index	23.9±0.8a	23.2±0.6a	25.9±0.8a	24.7±1.3a	1.541	0.26
Feed conversion rate	4.5±0.2a	4.0±0.5a	**6.5±0.4b**	3.6±0.2a	13.61	0.02

Effect of substrate type on mineral composition of BSF

Substrate	Mineral component (mg/kg)									
	Ca	Cr	Cu	**Fe**	Mg	Mn	**P**	**K**	**Na**	Zn
MW	406.6±0.8 a	0.1±0.01a	3.2±0.03a	**7.3±0.13b**	106.0±2.1 a	1.5±0.06a	**60.8±0.39 a**	**376.8±0.8b**	**120.4±0.8c**	20.8±0.7 a
MG	405.4±1.7 a	0.1±0.06a	3.1±0.02a	**8.5±0.09c**	106.1±4.1 a	1.4±0.04a	**63.3±0.24 b**	**373.8±0.7a**	**118.7±0.5b c**	21.2±1.3 a
MW+MG	405.4±2.2 a	0.04±0.02 a	3.2±0.02a	**6.3±0.21a**	100.9±1.7 a	2.1±0.62a	**63.0±0.08 b**	**375.0±0.4a**	**117.6±0.8b**	21.6±1.3 a
WB	405.8±1.1 a	0.1±0.03a	3.1±0.09a	**8.4±0.13c**	105.9±3.7 a	1.7±0.13a	**63.1±0.85 b**	**378.0±0.8b**	**114.5±0.9a**	21.0±0.8 a
F (3,8)	0.38	1.51	3.60	**160.5**	2.05	3.02	**17.58**	**24.68**	**34.58**	0.315
P	0.77	0.28	0.07	**<0.001**	0.19	0.09	**0.001**	**0.00**	**<0.005**	0.814

Effect of subtratetype on nutritional composition of BSFL frass

Parameter	Substrate				$F_{(3,8)}$	P
	MW	MG	MW+MG	WB		
Ash content (%)	16.6±0.38[a]	15.3±1.8[a]	19.0±2.1a	14.7±1.5	1.42	0.30
K(%)	10.1±0.3	1.3±0.5a	3.8±0.5a	a	37.8	<0.001
N(%)	b	0.42±0.0b	0.33±0.02a	0.32±0.0a	15.39	0.001
OM (%)	0.3±0.0a	84.7±1.9a	81.0±2.1a	85.3±1.5a	1.42	0.308
P(%)	83.4±0.3	0.31±0.01a	0.31±0.01a	2.2±0.02c	690	<0.001
	a					
	1.9±0.06					
	b					

Effect of frass fertilizer source on fresh weight of Amaranthus vegetable

Treatment	Fresh weight (g)	
	Season 1	Season 2
WB	37.7±7.7a	11.4±2.5a
DI	53.1±8.5a	8.7±1.2a
MW	61.1±9.3a	46.6±6.5b
MG	70.6±10.8	25.8±10.5
MW+MG	a	a
F (4,10)	60.6±4.3a	14.7±6.6a
P-value	1.58 0.26	2.22 0.01

Community outreach

Reciprocal International Exchange visits

Scientific outputs

1. Egonyu James P., Labu Simon, Anuso Sarah, Todi Isaac Okiror, Asiandu Lawrence, Andama Edward, Namusana Hellen, Avutia Ben Amos, Mugerwa Amos, and Akol Susan 2024. Recycling Biodegrdable Market Waste and Local Brewers' Spent Grain into Protein-Dense Animal Feed and Biofertilizer Using Black Soldier Fly. Oral presentation at The Busitema University STI symposium; 15th to 17th October 2024; Faculty of Engineering and Technology, Busitema University.

2. James P. Egonyu, Simon Labu, Sarah Anuso, Todi Isaac Okiror, Asiandu Lawrence, Edward Andama, Hellen Namusana, Ben Amos Avutia, and Amos Mugerwa (draft). Market Food Waste and Millet Spent Grain as Substrates for Producing Black Soldier Fly Larvae Meal and Biofertilizer. To be submitted to the Special Issue "Multidisciplinary STI Publications", in the African Journal of Science, Technology, Innovation and Development.

Take-home

- The project outperformed its set target
- BSFLtechnology has great potential for food systems circularity
- Research results indicate a need to integrate research to BSFL commercialization in different locations

Major challenges

- Insufficient finding for full infrastructural development and continuity
- Lot'sofresearch questionyet to be answered
- Establishment of the market for the products
- Sustainability of gains made as the project

Acknowledgement

- The Busitema University Technology, Business and Innovations Incubation Center (TBIIC), Award Ref.: TBIIC/GMC/02/2024/1.
- Government of Uganda
- The Grant Management Team
- Busitema University top management
- Team spirit of the core project team
- Students
- Research Assistant
- Other affiliate project team mates
- Good will of faculty fraternity
- The high interest of the community