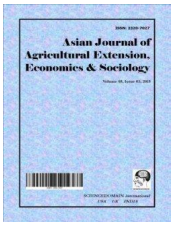

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Contributions of African Bird's Eye Chilli (*Capsicum frutescens*) to Household Income of Smallholder Farmers in Northern Uganda: A Case Study of Paicho Sub-County

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Authors' contributions

The initial concept development, mobilization of farmers, data collection and analysis were done by author GA. Training in agronomic practices and literature review were done by author JCWO. The authors collectively, developed full proposal, carried out the implementation, wrote project report, read and approved the final manuscript.

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ABSTRACT

African Bird's Eye Chilli, a non-traditional export crop in Uganda, is becoming an important cash crop to the rural farmers. Its growth potential remains unexploited. Rural farmers derive their livelihoods from the land, but there are limited high valued crops for export and chilli presents the alternative to diversification. This study focused on the adoption and contribution of chilli to the household income of rural farmers. A total of 100 households were selected randomly, provided with chilli seeds and trained in basic agronomic practices of growing chilli in Paicho Sub-county. Sixty households grew the crop on an average of 0.158 acres and obtained an average yield of 103 kgs of dried chilli. The households realized an average income of 781,400 UGX. Before chilli production, average income from farming activities was 1,028,900 UGX and overall average total annual income

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was 1,672,000 UGX per household. After chilli production, average income from farming activities rose to 1,345,700 UGX and the overall average total annual income rose to 2,181,050 UGX. Advantages of growing chilli were; easy management, quick maturity, high yield, ready market, good market price, low cost of production, seeds are easy to access and resistance to weather. However, chilli production faces some challenges such as; difficulty in harvesting, pests and diseases, low access to seedlings, difficulties in drying during the rainy season, requires storage facilities and price fluctuation. African bird's eye chilli is a potential cash crop for smallholder farmers; its production should be embraced and promoted in Northern Uganda.

Keywords: African bird's eye chilli; household income; smallholder farmers.

1. INTRODUCTION

Uganda is an agricultural dependent country like many other countries in Sub-Saharan Africa. The sector contributes nearly 20 percent of GDP and 48 percent export [1]. Additionally, the sector provides employment to 72 percent of the working population of which 85 percent live in rural areas and derive their livelihoods from the land [2,1]. However, 18 percent of the people in Uganda are chronically poor and 21 percent of the chronically poor people live in the rural areas and depend on agriculture and 26 percent of the people in Northern Uganda are likely to be chronically poor [2]. In this context, there is a marked interest in diversifying crop production, particularly within horticulture with a view to increasing foreign exchange earnings.

Apart from traditionally high-earning export crops like coffee, tea and vanilla, other export crops like pepper and chili constitute an interesting proposition for Ugandan agribusiness and have high growth potential. In particular, the African Bird's Eye Chili is being increasingly promoted in Uganda. As one of the most significant chili crops exported by developing countries to the world market, Bird's Eye Chili is commonly found throughout South and South-East Asian countries with India, Vietnam, Indonesia, China and Brazil being the worldwide leading exporters [2]. In Africa, it is mainly produced in Malawi as well as Zimbabwe, South Africa, Ghana and Uganda [3,4].

In 2010, Uganda exported US$ 496,000 worth of peppers and chili to the world market; including African Bird's Eye Chili. Exports to the European Union in particular constituted 82.86 percent or US$ 411,000 [1].

The end use of the chili is either that it is eaten raw or processed as a powder. Most bird's chilli is processed to extract the oleoresin for sale to food and pharmaceutical industries due to high pungency, color and medicinal properties. It is used in the manufacture of curry powder, pickle, curry paste, hot sauces [5]. Adding to this, the chilies are also useful because they are effective for farmers to combat pests and plant disease, hence the increasing interest for growing the crop in Uganda. Chili may either be exported fresh or more commonly dried [1].

In general, chili production in Uganda by smallholder farmers is done on the basis of a general plot size of 0.2 hectares to 2 hectares of land, of which a typical chili garden is in the range of quarter of 0.1 hectares to 0.4 hectares [1].

Chili may be grown either as a mono-crop or inter cropped with other crops, which is by far the most common case in Uganda. Bird's eye chilli has been grown as a neglected crop in very few pockets of the world and partnering with smallholder farmers could be an innovative platform to develop a sustainable solution meeting the vast demand at the African market [5,1].

2. MATERIALS AND METHODS

In March 2016, sensitization and mobilization were done through local leaders and 5 farmers groups with 20 members each were selected randomly, the 100 households were provided with chilli seeds and trained in basic agronomic practices, harvest and post harvest handling, grading and marketing chilli. The groups were; Dwere Lapit farmers group (Cwero), Kalamajji farmers group (Kinene), Onekji farmers group (Onekji), Rwotomiya farmers group (Paicho centre) and Awinyo Awinya farmers group (Tegot Atoo).

Monthly reports were collected from group coordinators and follow up were done to ensure that the practices were implemented rightly to achieve high quality chilli. Amounts of chilli sold

were recorded in all the groups and from extra farmers who grew chilli on their own but were selling the chilli through the group net work.

At the end of the year, focused group discussions were done with all the groups, all the group coordinators were interviewed as an individual basis and 43 farmers were randomly selected out of 60 farmers who managed to grow chilli were interviewed. The questionnaires captured the chilli production and also the common crops that are grown by the farmers on income and costs implication. Others sources of income were also captured to aid in understanding the contribution of chilli to household income and data were analyzed using SPSS (Version 23) for mean differences and results were presented in figures and tables.

3. RESULTS AND DISCUSSION

Out of the 100 randomly selected and trained farmers, 60 households managed to grow the crops at various sizes in term of garden size and the study found that the average size of chilli gardens was 0.158 acre. Details of the sale of chilli among the five participating groups showed that Dwere Lapit (in Cwero) was the best group in term of the total income got by the farmers, followed by Rwot Omiya group (Paicho centre), Awinyo Awinya group (in Tegot), Onekji group(Onekji) and lastly Kalamaji (in Kalamaji).

Cwero group performed significantly above the other groups in chilli production taking up to 62% of the total chilli production, followed by Rwotomiya (16%) and the rest. This was mainly due to exposure and the many people had witnessed the advantages of these crops perhaps the other group will rise up as well. About chilli production, 9.1% said not confident, 2.3% were somehow, 4.5% were neutral, 47.75% were confident and 36.4% were very confident in growing chilli. There was a particular group that performed very poorly that was Kalamaji. This was because the soil is sandy in nature making it poor in water retention. Most of the crops planted were destroyed by the mid year dry spell. Also, the attitude and exposure of the farmers in this area are another problem. The chilli was new to them and they still believe more in the local crops rather than these new emerging export crops. This group is somewhat similar to the group located at Onekji, located more inland from the main roads and less exposed to the trends and changes in the agricultural setting, unlike the other groups that are close and along high way roads. The farmers always want to have a witness and also observe with their eyes the benefit of a given crop before they can fall into production. Major crops grown alongside chilli were; bean (23%), maize (17%), soybean (19%), groundnuts (10%), rice (10%), sorghum (16%), millet (10%) and others (Fig. 1).

The report showed clearly that besides chilli, the farmers were growing other crops not only for food but also as cash crops. There is no distinct line which clearly separates cash crop; any crop could be cash crop based on many factors.

Table 2 showed average garden sizes (acre), average harvested (kgs), amount sold (UGX), market price (UGX) and average income (UGX) from these other crops. It was very clear that per kilogram income from the chilli was higher than all the others. Other sets of crops that could fetch good income to the farmers are vegetables such as tomatoes, cabbage onions, watermelon and others.

From the participating farmers interviewed, the average amount of income from farming increased significantly from 1,028,850 UGX (Cyan international baseline survey 2016-unpublished) to 1,345,700 UGX at the end of year one which was about 23.5%. The statistical median was 800,000 UGX and mode was also 800,000 UGX.

Table 1. Detail of chili produced and income got from the sales

S/no	Farmers group	Chilli sold (Kgs)	Chilli produced (%)	Income (Ugx)
1	Dwere lapit farmers group	2,886	62	24,531,000
2	Kalamaji farmers group	55	1	467,500
3	Onekjii farmers group	189	4	1,606,500
4	Rwotomiya farmers group	745	16	6,328,250
5	Awinyu awinya farmers group	314	7	2,664,750
6	Chilli from other external farmers	487	10	4,139,500
	Total	**4,675**	**100**	**39,737,500**

Table 2. Garden size (acre), Crops harvested (Kg/bunces/box/heap), Crops sold (UGX), Market price (kg/UGX) and income (UGX)

S/no	Crops	Garden size (acre)	Crop harvested (kgs)	Volume sold (kg/bunch/heaps/box)	Average market price per kg/heap/box/heaps (UGX)	Average income (UGX)
1	Bean	1.39	375.62	261.6	1556.2	475,611.1
2	Maize	1.1	270.2	293.3	800	260,000
3	Soybean	1.47	496.4	465.5	1200	618,000
4	Cabbage	1.3	650	650	1000	1,800,000
5	Groundnut	0.78	283	180	880	164,000
6	Rice	2.2	1034.2	500	2320	1,889,250
7	Watermelon	0.1	20	20	3500	70,000
8	Simsim	1.4	209	112.5	1828.5	227,125
9	Millet	1.14	386.6	210	1050	212,625
10	Sorghum	1.67	400	391.2	900	125,428.5
11	Cassava	1			1000	200,000
12	Tomato	0.557	15	15	70000	1,040,000
13	Cotton	1.1	387.5	387.5	1500	555,000
14	Chilli	0.158	103	103	8000	781,400
15	Pigeon peas	1	98.5	35	1500	45,000
16	Sweet potato	0.166	740	50	350	81,666
17	Egg plants	0.15	250	225	250	75,000
18	African eggplants	0.1	100	100	200	100,000
19	Banana	0.55	100	30	15000	450,000
20	Onions	0.1	100	100	2500	250,000

Table 3. Average income from the different sources

	Petty small business	Charcoal	Boda boda	Sale of labour	Government/NGOS	Other sources
Mean(Yr 1)	692,272.909	215,205.882	1,255,000	135181.818	300000	2816666
Mean	275,000	150,000	560,000	60000	300000	1650000
Mode	100,000	80,000.00[a]	100,000.00[a]	20000.00[a]	300000	300000

[a.] *Multiple modes exist. The smallest value is shown*

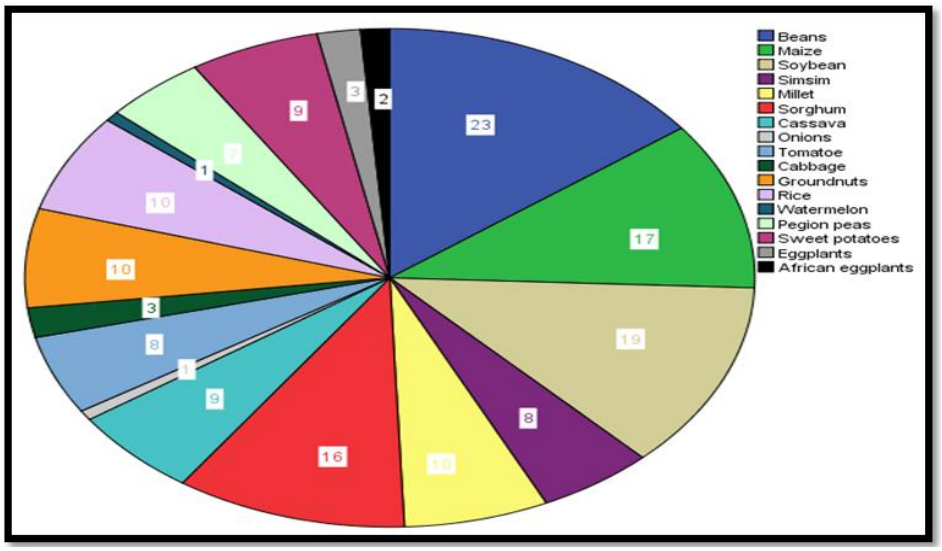

Fig. 1. Other crops grown by the farmers in Paicho Sub-county

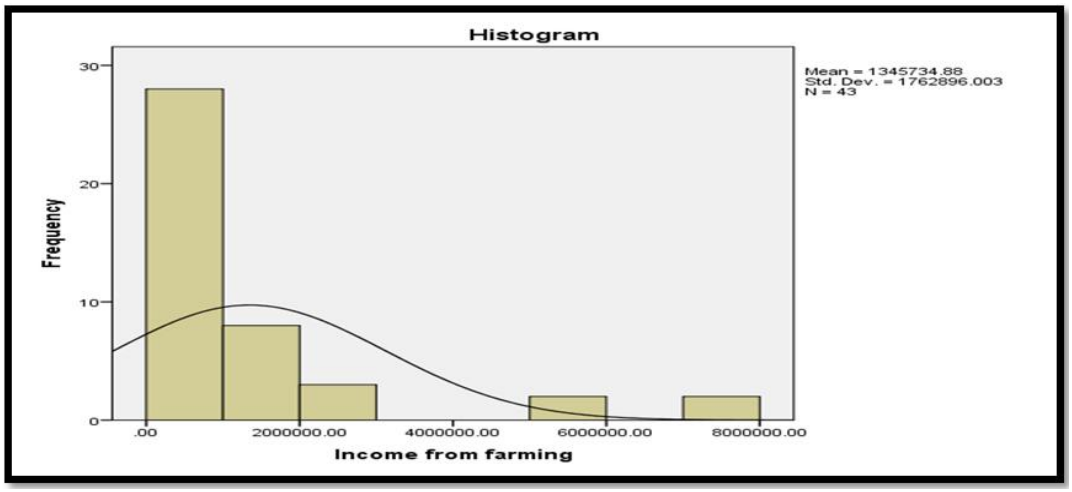

Fig. 2. Mean annual income from farming

Although many households got below the mean income as in the graph, there were good numbers that have achieved the mean income and above the average from the bench mark information. It is a clear indication of the increase in the amount of income that the farmers are getting from their farming activities.

According to Africa Uganda Business Travel guide [6], most farmers sell their chilli in raw and processed form to the companies at 8,000 UGX per kilogram of dried chilli. A kilogram of dried chilli was 3000 UGX and an area of 2 cares would translate to 2 million UGX in 2010 [7].

IDEA [8], reported that a well managed farm should be able to yield at least 1800 kgs of dried chilli per hectare meanwhile a recent study by International trade centre [9] and Tangue [10] showed that an acre of chilli should produce between 1,000- 4,000 kgs of dried chilli depending on management. It further reported that 3kgs of fresh chilli produced 1 kg of dried chilli and each plant produced 2-5 kgs per year. In Kenya, costs of production per acre were between 82,600-92,300 Kenya shillings and net revenue of 135,700-145, 400 Kenya shillings.

According to Uganda Export Promotion Board [3], the net revenue from an acre of chilli was 1,291,250 UGX at cost of 708,750UGX and report from Cyan international (Unpublished report 2016) showed that the net revenue from chilli was 4,000,000UGX at cost price of 1,500,000 UGX per acre in 2016.Chilli production does not require chemical sprays like other horticultural crops and also the demand for organic chilli is very high and has better market competition. Chilli solution itself can be used to control chilli pests. According to Teague [10], it is true that something as small as a pepper or a half acre plot of peepers can improve the lives of an entire family and thereby community.

The evaluation indicated that the farmers have other sources of income. They accepted that 41.3% do petty businesses, 30.4% burn and sell charcoal and 28.3% sale labour.

The analysis of the income from farming and those from other sources indicated that there has been an increment in the amount of income earned by the participating households from 1,671,950 UGX (Cyan international benchmark survey 2016 unpublished) to 2,181,050 UGX which is about 23.3%. This indicated the increase in the household income to be 509,100UGX. There were significant numbers of households that have moved higher above the benchmark average with their annual income, 32.6% of the household got income above the baseline total annual income meanwhile 67.4% fell below the average baseline. This could be because of the variation in the area planted under chilli, management and other agronomic practices and probably because many farmers found it labour intensive to harvest hence did not pick all their chilli in time and had big loss from the unpicked chilli. Much as that came with a lot of individual concentration and performance, the overall average total annual income increased by 23.3%.

Chilli and spicy farming accounts for an average of additional $28 per household member or $ 140 per year per family and because of lack of full or part time employment in rural areas, chilli is an economically attractive crop because it has two seasons for harvest hence two income streams per year, quick maturity and only requires small plot of land [10]. The bird's eye chilli also was a higher, more stable price than other products as they are sought after on the international market. It has sizeable international demand from food manufacturers, pharmaceutical companies and manufacturers [10].

Further analyses were conducted to find out the spending made by these households on weekly basis. The result indicated that 41.4% spend their money on food, 17.2% on travel/boda boda, 7.8% on cloths, 31.9% on health and 1.7% on others. .

3.1 Use of Money by the Farmers

Financial investment and prioritization is a key to rural development and transformation. In other words, what can the farmers do to ensure that their levels of farming grow and as well the general status of the family to improve. All these need resilience prioritization and spending wisely to achieve change in life.

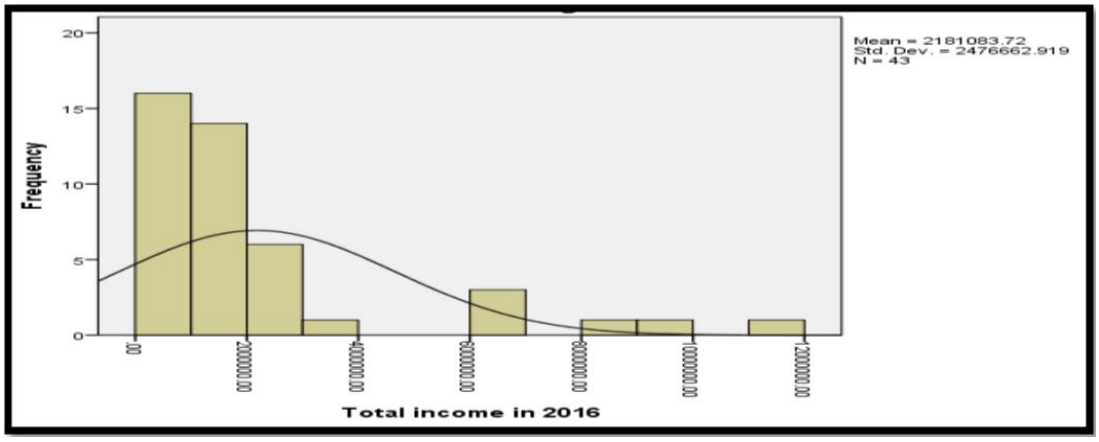

Fig. 3. Mean annual income of participating households

Table 4. Amount of money spent in a typical week, month

Benchmark 2016	Food (UGX)	Bodaboda (UGX)	Health on monthly basis (UGX)	Clothing (UGX)	Others (UGX)
Mean	22,125	11,209.3	21,098.3	11,575	20,000
Mean after yr 1	17,956.521	21,050	41,944.44	13,0875	20,000

a. Multiple modes exist. The smallest value is shown

The farmers were asked to mention the use of their money after the sale of crops, labour or money got from other sources. Acquiring livestock, household needs; medical treatment and school fees were on the top spot on how the farmers use their money. According to Teague [10], chilli farmers use their income for paying school fees, health care, home construction and purchase of boda boda (Motorcycles or bicycles) that can increase family income by helping to move produce or be hired out as taxi. Other uses of money included; building, Transport, solar panel, home furniture, marriage, phone, starting business, buying television and land as captured in Table 5.

3.2 Benefits and Challenges of Growing Chilli

Benefits of growing chilli mentioned by the farmers were as follows; Chilli has good market price, easy management, high yielding, good source of money which is in agreement with a report from Ghana which said that bird eye chilli has higher value compared to the long chilli [11], mature quickly, resistant to pests and diseases compared to other crops, Low cost of production, good potential cash crop, Seeds are easy to access and some mentioned that chilli is resistant to weather. In the group discussion, the farmers cited that Chilli was a good crop because of good market price, resistant to dry weather, and ready market, good source of income. These answers were similar to the question asked at individual level.

Much as chilli has quite a number of benefits to the farmers, they also mentioned some of the challenges that are associated with chilli farming which included; difficulty in harvesting, chilli is affected by dry weather especially in the dry season, some farmers mentioned pests and diseases as challenges to chilli production, which was in agreement with Africa Uganda business travel guide (2016), that reported thrips, mites aphids and pod borers among the pest that affect chilli production [12]. They reported fruit rots, bacterial wilt, leaf spots which can be avoided by careful selection of quality seeds which are diseases free.

Table 5. Use of money by farmers

	Frequency	Percent	Valid Percent
Agriculture	9	5.5	5.8
Livestock	24	14.6	15.4
Transport	9	5.5	5.8
Home furniture	6	3.7	3.8
Solar panels	3	1.8	1.9
Building	4	2.4	2.6
Household needs	33	20.1	21.2
School fees	34	20.7	21.8
Marriage	5	3.0	3.2
Phones	1	.6	.6
Radio	3	1.8	1.9
TV	1	0.6	0.6
Buy land	3	1.8	1.9
Start business	5	3.0	3.2
Medical treatment	15	9.1	9.6
Other specify	1	0.6	0.6
Total	156	95.1	100.0

Table 6. Benefits of growing chilli

	Frequency	Percent	Valid percent
Ready market	9	5.5	25.7
Good market price	13	7.9	37.1
Easy management	2	1.2	5.7
High yielding	1	.6	2.9
Good source of income	3	1.8	8.6
Quick maturing	1	0.6	2.9
Resistance to pests and diseases	1	0.6	2.9
Low cost of production	1	0.6	2.9
Potential cash crop	1	0.6	2.9
Easy to get the seeds	1	0.6	2.9
Resistant to weather	2	1.2	5.7
Total	35	21.3	100.0

Table 7. Challenges of chilli production

	Frequency	Percent	Valid percent
Harvesting is hard	18	11.0	50.0
Pests and diseases	1	.6	2.8
Dry weather	9	5.5	25.0
Labour intensive	1	.6	2.8
Takes so long in nursery	1	.6	2.8
Termites	3	1.8	8.3
Problem of weeding	2	1.2	5.6
Drying difficulty in rainy season	1	.6	2.8
Total	36	22.0	100.0

Chilli production is labour intensive which is in agreement with Drasimaku [7] who wrote that hand picking and drying of chilli were tidious processes; caused eye and nose irritation and that only a few farmers could afford protective gears. Termite damage to chilli especially in the dry seasons was devastating. Chilli seedlings take so long in the nursery, some farmers mentioned the challenge of weeding and also dry the harvested chilli in the rainy season was mentioned as a big challenge as this affected the quality of the dried chilli. They mentioned requirement for storage facilities, dry weather, harvesting was done by the farmers at different time and bulking for sale was a challenge, labour intensive, pests and diseases.

These were the challenges that were associated with chilli production given by the farmers and on individual interviews. They mentioned requirement for storage facilities, drop in market price towards the end of last year, dry weather, labour intensive, pests and diseases.

They also gave some ways through which chilli production could be improved. They mentioned that market for the chilli should be ready, price in market should be stable, more training on chilli production, early planting, provision of insecticide to control mites and aphides in midyear dry period and contract farming should be introduced to the farmers to guarantee the market.

4. CONCLUSION

Chilli is a crop that has joint the categories of high value crops that could be a big source of earning to individuals and the country such as Uganda. In rural areas, the crops grown have low market prices but chilli seems to have relatively high prices compared to other crops, it's a resistant crop, easy to grow, harvested twice in a year and can last for three years as the farmers just manage the field. Rural farmers can easily earn a reasonable income from their small piece of land especially at the time when the population is increasing and there is great pressure on agricultural land. Chilli is a short return crop with low cost of investment compared to other crops and yet it is harvested throughout the year. With the ready market, stable price, more training on chilli production, early planting, provision of insecticide to control mites and aphides in midyear dry period and contract farming to guarantee the market, chilli production could expand significantly.

5. RECOMMENDATION

Chilli production should be taken up by the both the farmers and other stakeholders in the Agricultural sector. It presents a great opportunity for export and diversification of the sources of income to the farmers. With the various uses in pests control and human disease treatment such as in local medicine by herbalists who prepare ointment for rheumatism and joint pains [13], chilli production has enormous benefits to the community. It is recommended that the players in the export market play their roles well since the greatest threats to production are lack of market and fluctuating prices. More market opportunities and linkages should be done to enable relatively stable prices and if possible the export deal directly with the farmers since the middlemen tend to suppress the farmers by offering very low prices that discourage the farmers from continuing with chilli production.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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