

*Department of Soil Conservation
& Watershed Development,
Government of Odisha and
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New Delhi, India*



**A Road Less Travelled by
Migratory Farmers of
Odisha: Innovative
Agroforestry Practices**

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A success story of migrant farmers from Bolangir and Nuapada districts who have adopted innovative agroforestry practices, including intercropping with bio-fortified staple food crops, vegetables and an agro-voltaic system in order to come out of the migration cycle and improve food, nutritional and income security for their families.

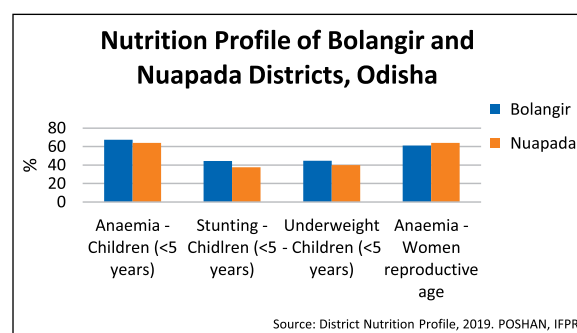
The Havoc of 2Ms: Migration and Malnutrition

Migration and malnutrition seem to be the two faces of the same coin. Throughout India, the rural population, especially farmers and landless labourers, undertake an annual seasonal migration to neighbouring states in search of better livelihoods. A dependable database is missing that could help extend organised, formal support, especially in times of distress, such as under COVID-19 restrictions.

According to official reports, over 543,000 migrants returned to Odisha amid the COVID-19 pandemic¹. Non-governmental organizations working in Odisha on migrant issues have estimated close to 300,000 individuals annually migrate from western Odisha alone. Eleven of the state's 30 districts are classified as 'migration-prone' and Bolangir and Nuapada districts are the

worst among these (Tata Trust-Horizons 2019). A 2016 survey² mapping 38,000 households across 30 gram panchayats (village councils) in Bolangir and Nuapada revealed that about 36% of the population left Odisha in search of work. Immigrants usually do not register with the labour department, therefore, Government records are often unable to capture the migrant volume.

Those migrating from Bolangir and Nuapada districts are mostly small-scale and marginalized farmers and landless labourers who are often resource-poor and faced with malnutrition owing to prolonged food and nutritional insecurity. In the national nutritional



¹Over 5.43 lakh (One lakh = One hundred thousand) migrants have returned to Odisha as of 14 June 2020. <https://bit.ly/35yhywD>

²Tata Trust-Horizons. 2019. Call of the North East. March 2019 issue. <https://bit.ly/33uO2oK>

ranking, Bolangir ranks 531 and Nuapada ranks 589 among 599 districts in India³.

In both districts, more than 60% of women under reproductive age and children less than five years of age suffer from anaemia. Stunting and underweight among children of less than 5 years of age is close to 40% in both districts.

The annual seasonal migration adds to the effects of the existing malnutrition, especially for women and children, owing to intense, laborious work as brick kiln or construction workers. With the limited income generated from such work, the nutritional requirements of the family can hardly be met. Many times, only men of the family migrate, leaving the elderly, women and children at home. But sometimes the whole family migrates, which adds further plight to the suffering of the elderly, women and children. Usually, conditions are harsh and tough under which these migrants live and work, including, sometimes, not even getting their due labour cost despite extra work hours. However, situations such as dwindling income from farming, loans from local lenders at very high interest rates, and the wish to provide better livelihoods for their children, keep pushing these farmers to take up the annual ritual of migration. Generation of a small but much needed additional estimated income of Rs 60,000–70,000 per annum at their place of usual residence is all that is required to save migrating families from these sufferings.

³Poshan: Led by IFPRI. 2019. District Nutrition Profile. <https://bit.ly/3iugVaS>

A visionary change in farming that has reduced migration

The International Centre for Research in Agroforestry (ICRAF, also known as World Agroforestry; worldagroforestry.org) and the Centre for International Forestry Research (CIFOR; cifor.org) in collaboration with the Department of Soil Conservation and Watershed Development and other line departments of Odisha with funding from the Government of Odisha, initiated a project titled, **Enabling Smallholder to Produce and Consume more Nutritious Food through Agroforestry Systems in Odisha** (<https://www.worldagroforestry.org/project/enabling-smallholders-odisha-produce-and-consume-more-nutritious-food-through-agroforestry>), in May 2018.

The team of the Odisha Agroforestry Project identified food insecurity, limited local employment options, dwindling returns from agriculture owing to

Working with migrants has twin challenges

First, dissolving farmers' myths about losses from agriculture; and, second, building confidence to adopt advanced technologies, such as agroforestry vis-à-vis their food and nutritional requirements, capacity to adapt, knowledge and available resources.





Smile of success: Balabhadra and Ajodhya with examples of their watermelon harvest.

Photo: World Agroforestry/Narsingh Behera

frequent droughts and floods, and shortages of water as the major challenges for farmers in the area. This led to the cultivation of only one crop per year, which is the main reason for seasonal migration from the project's targeted districts of Bolangir and Nuapada.

Migration and malnutrition: both are linked by the regular failure of crops and low incomes from agriculture, especially for marginalized and small-scale farmers, which often leads to the abandonment of agricultural land.

Based on land ownership and agriculture practices in the two districts, the migrant families can be classified into three categories: 1) landless; 2) practising agriculture, however, leaving the land

fallow in winter; and 3) not practising agriculture and the land is abandoned.

There are, however, 'agents of change', such as Mr Tirtha Bariha and Mr Balabhadra Mallik from Bolangir district and Mr Lakhan Majhi from Nuapada district, who have a desire to break the decades-long migration cycle. They are participating in the Odisha Agroforestry Project, among more than 3200 migratory farmers (including 1893 backyard growers' families led by women) participating in various activities of the project.

Major objective of the project is to improve nutrition through a diversified agroforestry systems, such as introduction of fruit trees along with bio-fortified and high-yielding staple



food crops to help reduce in-country migration of small-scale farmers. The project has built a cadre of 58 youth living within the targeted 140 villages in Bolangir and Nuapada districts who are trained as *Krishi Vaniki Mitra* (KVM/Friends of Agroforestry) to mobilize farmers to adopt the project's interventions and support the project team and participating farmers. This is an exit strategy of the project as these well trained KVMs are expected to continue supporting community members beyond the life of the project.

A wave of transformation through agents of change

In 2018, Tirtha Bariha, who practices agriculture, leaving the land fallow in winter, broke his 15 year-old migratory cycle of moving to Andhra Pradesh or Kerala to work in a brick kiln. The entire family of 5 decided to take the challenge of improving their living through adoption of agroforestry-based interventions, including an agro-voltaic system. Another agent of change, Balabhadra Mallik and his wife, Ajodhya Mallik, decided to give agriculture a second chance against their 8 year-old practice of abandoning agriculture and migrating to Andhra Pradesh. Lakhan Majhi opted out of his migration cycle of 10 years as a brick-kiln worker in Uttar Pradesh to take care of his newly planted fruit trees planted through the project and harvest the benefits of the advanced cropping system.

Out of a 1.62 hectare landholding, **TIRTHA BARIHA** used 0.82 hectare to plant a local rice variety while his upland remained uncultivated owing to unavailability of water. Growing rice gave him a merge earning of Rs 4000 per year, which made meeting the needs of a five-member family a very difficult task and drove him to migrate year after year. Tirtha and family usually earned Rs 60,000 to 70,000 in 6–7 months working as a brick-kiln worker in Andhra Pradesh or Kerala.

Things started changing for Tirtha Bariha and his wife Nuadei Bariha when they attended one of the awareness programs of the project organised during 2018 in Salandi Village of Bolangir District. Learning about the immense benefits of agroforestry, Tirtha and Nuadei decided to adopt the project's activities to mitigate the challenges of drought, water scarcity and a high-interest loan of Rs 20,000 taken to pay for Nuadei's medical treatment.

With technical guidance and support from the Odisha Agroforestry Project, in 2018 Tirtha planted fruit trees of mango (*Mangifera indica* var. Amrapali), guava (*Psidium guajava* var. L49 and VNR-Bihi), Apple ber (*Ziziphus mauritiana*) and drumstick (*Moringa oleifera* var. PKM-1) in the upland land parcel. He also planted a high yielding rice variety, MTU1010. His confidence in the project's interventions tremendously increased after harvesting 1670 kg of rice from the small piece of



Nuadei harvesting green chillies intercropped with fruit trees.

Photo: World Agroforestry/Badri Naryan Sahoo

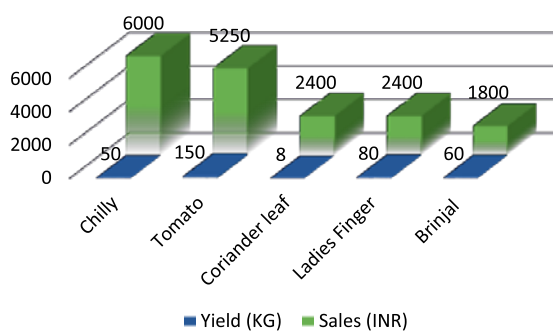
land of 0.41 hectare, averaging to a yield of slightly more than 4 tonnes per hectare, much higher than the yield of the local rice variety he was previously growing. With a higher income, regular training and continuous 'hand-holding' by the KVMs, Tirtha decided not to migrate during 2018 but to remain and continue participation in the project's interventions.

During 2019, the project in collaboration with the Indian Council of Agricultural Research's (ICAR) National Rice Research Institute, Cuttack, helped to grow a protein-rich (10% protein) biofortified

variety – CR 310 – on the 0.41 ha area along with 110 saplings of fruit trees and vegetables such as eggplant, tomato, onion, coriander, chilli and okra. Continued technical support by the project team and the hard work of Tirtha and his family led to the harvest of 2034 kg of biofortified rice from the 0.41ha, valued at Rs. 36,917 based on the Government-declared minimum support price (MSP) for non-protein rice varieties. His income from rice increased by about Rs. 27,152 (278%) from the district average. Besides, the family harvested vegetables every alternate day and earned an estimated Rs. 17,850 by direct selling to local traders. Among the vegetables, coriander was the highest value – lowest volume crop; while chilli was the highest value crop followed by tomato. He also planted 250 root slips of high-yielding Napier grass on the boundaries of the fields, which produced approximately 1.2 tonnes of green forage, valued at approximately Rs 3600.

Tirtha took another revolutionary step by devoting about 93 m² of his land to establish an Agroforestry-Agri-Voltaic

Tirtha's Vegetable Yields and Income from its Sale





Agroforestry-Agro-Voltaic System installed on the farm.

Photo: World Agroforestry/Badri Naryan Shao

System (AAVS). ICRAF, in partnership with ICAR’s Central Arid Zone Research Institute, jointly designed a 5 KW AAVS that accommodates fruit trees on its north–south boundaries and shade-loving crops under and in between the solar cells.

The AAVS, depending on per-day sunshine, can generate an average 1250 KW electricity per month valued at Rs 3488 at current market rate of Rs 2.79 per unit. Most of the electricity produced is currently used to run an irrigation pump and for domestic purposes. Thus, the AAVS is already generating an income (and saving) of Rs 3488 per month.

With the availability of electricity resulting in a regular water supply, Tirtha is now able to produce two crops of high-yielding rice in a year. He has increased the rice-growing area from 0.42 hectare to 0.82 hectare, grows good-quality vegetables and has access to safe drinking water. Thus, through the support of the Odisha Agroforestry Project, Tirtha is able to generate an income of Rs 85,077, which outperforms his income through migration by 17.7%. Soon, his more than 116 fruit trees will be adding additional nutritious food and cash income, increasing the overall income of the family to much greater levels than what he was generating by migrating.

‘I was able to clear all the debts and our living conditions have significantly improved,’ said Tirtha. ‘We need not migrate for a living anymore.’

His wife, Nuadei added, ‘We are now a respected member of the community and our children are no longer exposed to the harsh conditions of yearly migration.’

With the increased income, Tirtha is aiming to buy additional land and planning to provide a good education for his grandchildren.

BALABHADRA MALLIK, a native of Dhumabhata Village of Bolangir District, owns 1.2 hectares of ancestral land. Forced by an increasingly dwindling annual income (Rs 30,000 to Rs 40,000) from agriculture, in 2012, Balabhadra along with his wife Ajodhya Mallik, started annual migration as a brick-kiln worker in Andhra Pradesh.

As migratory workers, both together earned about Rs 60,000 per year, which was much higher than the low return from agriculture. For the past seven years, the family annually migrated to Andhra Pradesh in November and returned to the village in June. When in the village, besides working in their fields, both would also work as agricultural labourers to make ends meet.

On their annual return from Andhra Pradesh to the village in 2018, Balabhadra and Ajodhya observed the new technologies introduced by the project and were encouraged by their fellow farmers to adopt the interventions. Anxious to know more,

Balabhadra and Ajodhya attended the village training offered by the project team, which covered several topics, such as advanced agriculture and agroforestry and its management.

After several interactions with the KVM in their village and with the project team, Balabhadra decided to give agriculture a second chance and stayed in the village rather than migrate.

As a first step, during 2019 the farm that was left barren for the last 7–8 years was levelled and with support from the project, 92 high-quality fruit trees consisting of mango (*Mangifera indica*), apple ber (*Ziziphus mauritiana*), guava (*Psidium guajava*), drumstick (*Moringa oleifera*) and aonla (*Emblica officinalis*) were planted with a sub-surface irrigation system. To their pleasant surprise, the guava trees already started fruiting during 2020, which boosted their confidence. To meet the irrigation requirements and reduce his expenditure on water, the project supported him to dig well to

Fruit trees (covered in tree guards) planted in rows in the field and at the boundary.

Photo: World Agroforestry/Badri Naryan Sahoo





Balabhadra with his watermelon intercropped with guava and other fruit trees, watered by a sub-surface irrigation facility.

Photo: World Agroforestry/Isvar Padhan

irrigate the farm and fill the sub-surface irrigation system. With the well, Balabhadra started saving Rs 1000 per month, which he used to pay for another dug well for another owner to irrigate his field as well.

The approach of sub-surface irrigation reduced the irrigation frequency to trees during hot summers from alternate days to every 8th to 10th day, reducing the use of water by 1/8 to 1/10 times, with a significant saving in time otherwise spent on frequent irrigation of tree seedlings.

Cultivation of biofortified rice variety CR310 on about 0.41 hectare led

to the production of 2192 kg of rice valued at Rs 39,785 at the 2019–20 market rate of Rs 18.15 per kg.

With their first agricultural income in hand, during November 2019 Ajodhya and Balabhadra, in discussion with the project team, took a conscious decision not to migrate and continue working on their small farm. They were supported in growing watermelon as an intercrop with the fruit trees on about 0.24 hectare with a proper



Balabhadra with his bumper watermelon harvest.

Photo: World Agroforestry/Kapileshwar Mohapatra

water drainage channels, leading to the harvesting of 8.2 tonnes of good-quality watermelons. Besides consuming the nutritious and refreshing fruits in summer, the family earned a total of Rs 45,000 for the whole season.

With continuous hand-holding and technical guidance on preparing proper drainage channels while planting watermelons with a 15 days' delay, Balabhadra was able to save the melon crop from the usual damage just before harvest time. His fellow watermelon farmers incurred heavy losses of Rs 40,000 to 60,000 because the crop was damaged owing to waterlogging after heavy rain.

Both Balabhadra and Ajodhya are extremely proud and happy with their decision of staying and adopting the advanced technologies. With an income of Rs 84,858 in hand (better than their income as migratory labourers), they plan to buy productive land.

'We strongly suggest to fellow migrant farmers to adopt new technologies and work on their farms for themselves and do not migrate to work and face harsh conditions and still earn poorly,' said Balabhadra with Ajodhya.

LAKHAN MAJHI, traditionally a migratory farmer, is our key agent of change from Kuliabandha Village, Nuapada District with 1 hectare landholding. This small patch of land supports the family of six, including his wife, three sons and one daughter. The miseries of the Majhi family are no different from other farmers with low and erratic income from regular crop loss and limited opportunities for work within their community. Such conditions had been compelling Lakhan to migrate with his entire family to Uttar Pradesh from 2009 until 2012 as a brick-kiln worker, earning approximately Rs 50,000 during six months of his stay there.



Village training on agroforestry and advanced agricultural technologies.

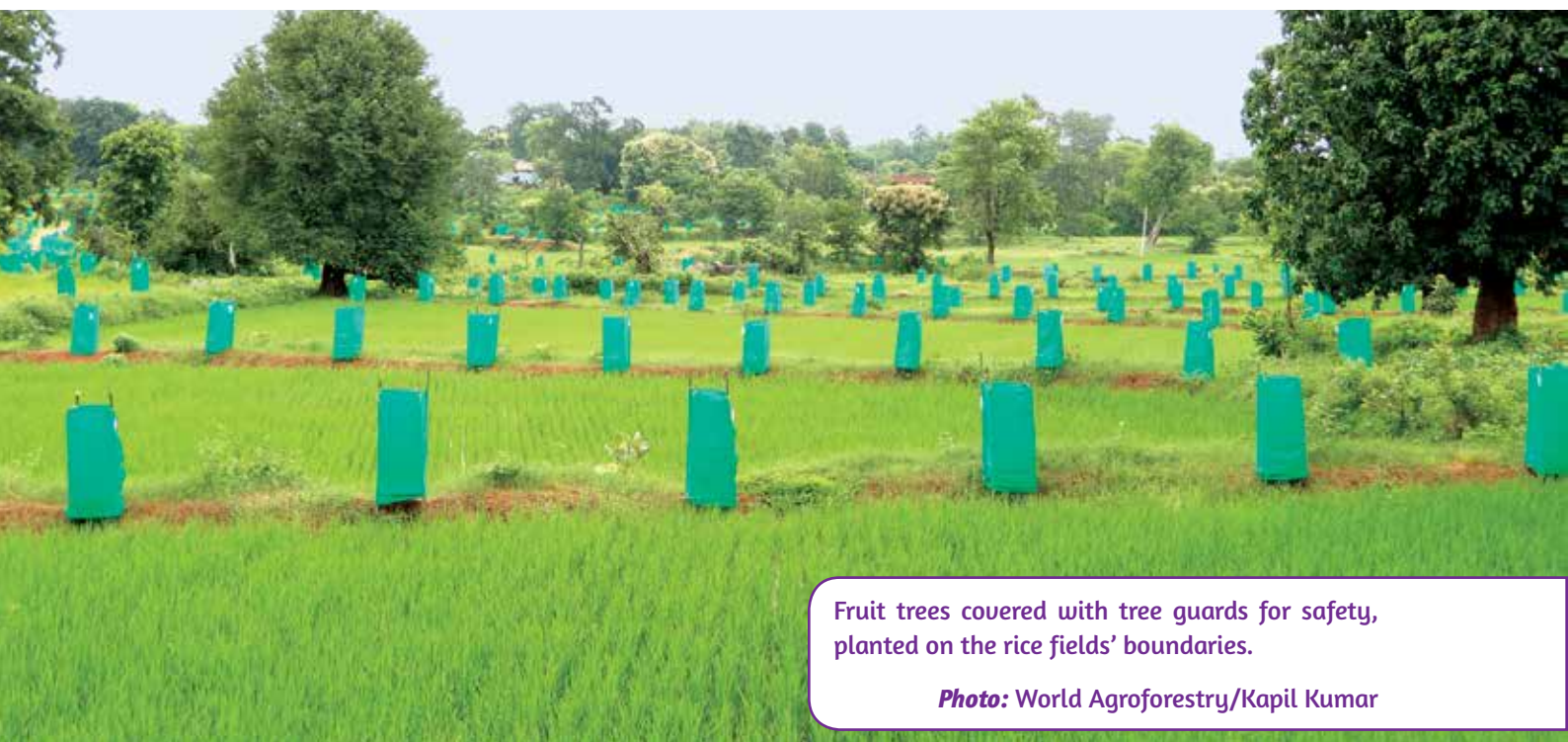
Photo: World Agroforestry/Somanath Sahoo

He stopped migrating in 2013 after receiving support from the Department of Soil Conservation and Watershed Development, Government of Odisha to establish a fish pond in his field, which partially resolved his water availability problems during critical months, and improved his rice yield. He also received support for digging a well for water, however, to this date, he is unable to use it fully owing to limited availability of electricity. Though his situation had improved, the income was still not enough for a family of five. Therefore, instead of Lakhan, his son Mahesh Ram Majhi, started migrating to Uttar Pradesh to bring much required additional income of Rs 50,000 to 60,000. Under this setup, they were able to live a self-sustaining life although with limited resources, with a constant fear of crop loss.

In 2018, Lakhan Majhi attended one of his village's awareness training sessions,

organised by Odisha Agroforestry Project, and was encouraged to adopt some of the activities of the project. The project supported him by providing seeds of the high-yielding rice variety MTU1010 and saplings of fruit trees, namely mango (*Mangifera indica*), guava (*Psidium guajava*), apple ber (*Ziziphus mauritiana*), lemon (*Citrus limon*), papaya (*Carica papaya*) aonla (*Emblica officinalis*), which he planted on the fields' bunds. Lakhan was able to harvest 1700 kg of rice, amounting to a yield of 4199 kg per hectare, which is 49% higher than his previously grown local variety. His rice was valued at Rs 30,090 at the minimum selling price for 2018–2019.

With the knowledge gained through various training sessions organised by the project and observing higher yields from his farm, Lakhan decided that none of the family members need migrate henceforth. The family instead opted



Fruit trees covered with tree guards for safety, planted on the rice fields' boundaries.

Photo: World Agroforestry/Kapil Kumar



to work with the project team. They received 70 fruit trees in 2019 and seed of high-protein biofortified rice variety CR Dhan 310.

To reduce the number of irrigation incidents for the fruit trees, a sub-surface irrigation facility was provided for each tree, which significantly saved water and labour costs. At the end of the growing season, he harvested 2800 kg of rice from 0.41 hectare, valued at Rs 50,820 at the minimum selling price of 2019–2020. As well, the family is already harvesting guava and papaya and are looking forward to receiving significant additional income when all the fruit trees start production. Lakhan is among the pioneers who have adopted an alley-cropping system of agroforestry, growing maize and vegetables as an intercrop with trees, which has added to their family income.

With improved knowledge of cropping and agroforestry systems, now Lakhan is confident of a gradual enhancement of income through fruit trees. The family is expecting an estimated income of Rs 100,000 to 150,000 in coming years.

'We are happy that now the children can get nutritious food and protein-rich rice,' said Lakhan. 'We look forward to selling the surplus fruits in the market.'

All-inclusive growth approach

The project team adopted an inclusive approach for the growth of all community members and included landless



Fresh and nutritious vegetable produce from a backyard nutri-garden.

Photo: World Agroforestry/Iswar Padhan

migratory farmers and women to participate in the project's interventions. The farmers were engaged in the project's activities for 2594 labour-days and were paid as per Government norms.

To reduce the drudgery of women and improve access to nutritious food, the project assisted 1893 migrant women-led households to establish backyard 'nutri-gardens'. These women were provided with vegetable seeds of eggplant, onion, chilli, tomato and coriander along with saplings of fruit

trees, namely moringa (*Moringa olifera*), papaya (*Carica papaya*), guava (*Psidium guajava*), aonla (*Embllica officinalis*), lemon (*Citrus limon*) and apple ber (*Ziziphus mauritiana*). The vegetables provide much-needed nutrition and the fruit trees increasingly add essential vitamins B, C, A and minerals, such as calcium and iron, to their menus, contributing significantly to reducing the rampant malnutrition.

Improving production and consumption of nutritive food

With the project's interventions, farmers' yields of rice in Bolangir increased by 282% compared to the district average yield of local rice varieties (Table 1). Migratory farmers, during the summer months, were able to harvest biofortified rice CR Dhan 310 at the rate of 5017 kg per hectare and, in winter, grass

pea at the rate of 625 kg per hectare. The winter crop is an addition to the farm basket for the migratory farmers because they usually leave their land fallow owing to unavailability of water. The farmers followed their usual pattern of keeping 50% produce for their consumption and sold the remaining in the market. With the increase in yields and producing biofortified crops, the income of farmers has also increased.

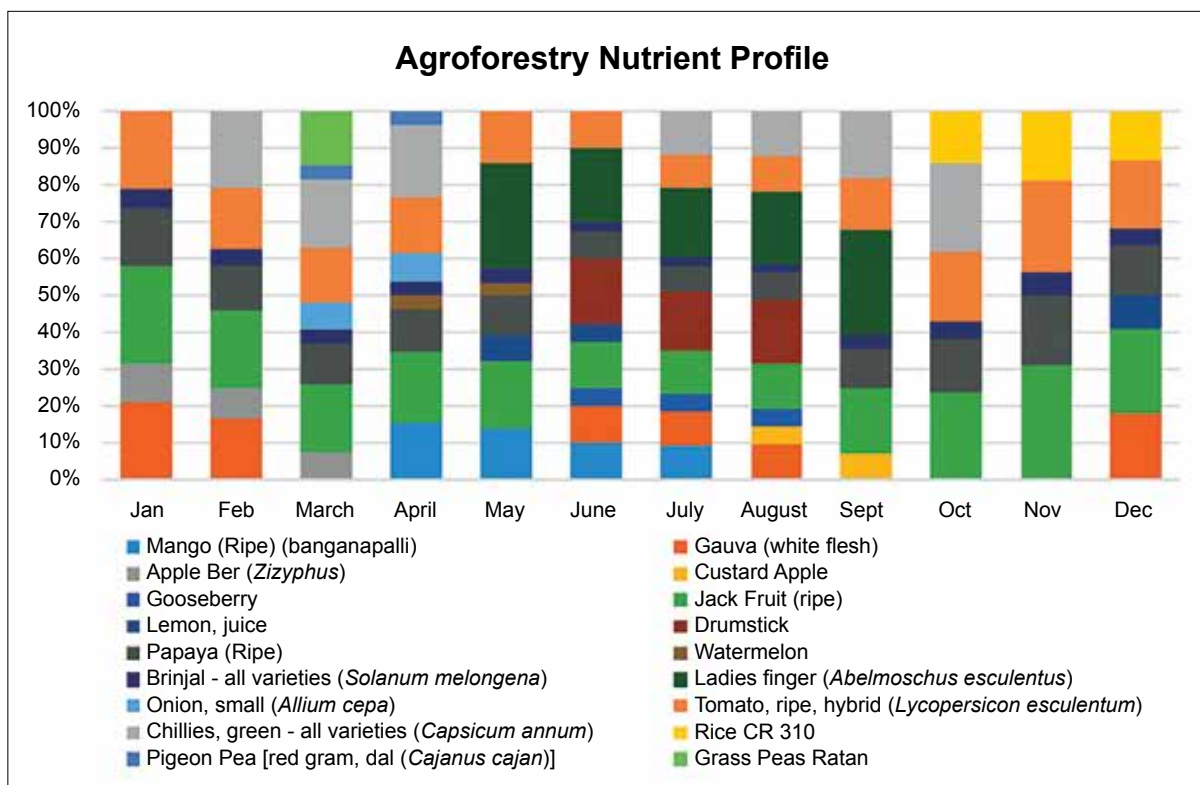
The addition of biofortified rice, grass pea (var. Ratan/Prateek-low toxin and high yielding) and vegetables on the food platter of participating farmers, including migratory farmers, is adding much required daily requirements of vitamins and minerals, such as zinc and iron, and proteins. The biofortified rice has increased per hectare availability of 1,55,527 ppm zinc, 1,49,005 ppm iron and 500 kg of protein, which are essential for good health. Fruit trees — such as guava, papaya, apple ber and

Table 1. Increases in yield and income with project varieties

Project intervention	Yield (kg/ha)		Per ha increase in income (Rs.)
	Farmer's variety	Project variety	
Rice	1313	5017 (CR Dhan 310)	67,228 @ Rs 18.15/kg*
Grass pea	0–60	625	16,950 @ Rs 30/kg#
Eggplant	15,000–20,000	20,000–25,000	90,000 @ Rs18/kg#
Tomato	10,000–15,000	15,000–20,000	1,60,000 @ Rs32/kg#
Chilli	5,000–8,000	8,000–11,000	6,54,000 @ Rs 218/kg#
Okra	6,000–8,000	10,000–12,000	1,20,000 @ Rs30/kg#

*Rice Minimum Support Price (MSP) of Odisha for 2019–2020

#<https://agmarknet.gov.in>, June 2020 wholesale price for Bolangir



drumstick — have started bearing fruit with 100 g of edible portions, which have enriched the food quality of farmers with 996 µg of vitamin A, 214 µg of vitamin C from guava; 46 mg of calcium and 62 µg of vitamin B complex from apple ber; and 358 µg of vitamin K, 350 µg of vitamin A, 0.73 mg of iron, and 419 mg of potassium from drumstick fruit; all of which are essential for growth and building a strong immune system as well as reducing stunting in children. Selection of fruits and vegetables is done in a way to provide year-round nutritious food to participating farmers, as shown above in the graph of agroforestry nutrient profile from the package of practices established through the Odisha Agroforestry Project.

The project introduced innovations with enormous potential to support the overall aim of the Government of Odisha to reduce migration and diminish the sufferings of the migratory farmers.

Summarizing the results obtained so far, ICRAF South Asia director, Javed Rizvi, said, 'We understand an annual earnings of Rs 60,000–70,000 (USD 822–960) at home could save families from the disadvantages of migration. We are seeing successful farming right at home without the need of migrating, if farmers adopt the techniques introduced by the project coupled with capacity development and hand-holding during initial years.'





Fresh and nutritious fruits now grow in backyards

Photo: World Agroforestry/Somanath Sahoo



Acknowledgment

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