ASPARAGUS CASE STUDY- A NEW CASH CROP FOR ORONG GEWOG

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Executive Summary

This is the first report of commercial asparagus production in Sandrup Jongkhar. Asparagus is a long-term investment for farmers, but the vegetable group of Orong has taken up the challenge of commercializing this rare, but valuable crop. Yield and economic impact assessments are still a few years away, but overall the asparagus appears to have found a permanent home in the gewog. Some farmers are even preparing to save and distribute seed to increase future acreage. This pilot impact study will not only help the farmers of Orong's vegetable group, but will supplement the nutritional program of Orong's primary school, and in time, will be made available across regional markets.

INTRODUCTION AND BACKGROUND

Layrong, Dengzor, and Mornog are chiwogs (villages) under Orong gewog, Samdrup Jongkhar dzongkhag. These chiwogs are characterized by having a mid-hill elevation, sub-tropical climate, maximum and minimum temperatures of 25°C and 10-15°C, respectively, monsoon precipitation, and an elevation range from 1300 to 1700 m above sea level. The soils are diverse depending on location, but consist of various proportions of silt and clay and range in color from dark red to grey. Soils are generally thin with a varing prevalence of stones and gravel providing free drainage.

Orong is sparcely populated with only approximately 500 households stretched over 82 km^2—87% of the total area is in forest (11^{th} Five Year Plan; Royal Government of Bhutan). Agriculture is the main source of income for 75% of the population that has small (<2ha) land holdings.

Maize is the staple crop and is dryland farmed primarily during the summer monsoon. Mandarin orange (*Citrus reticulata*) is the main cash crop and its development is supported by the ministy of Agriculture (11^{th} Five Year Plan; Royal Government of Bhutan). Vegetable production also contributes to the economic sustainability of farmers and is dependent on limited irrigation recources. There are seven agricultural cooperatives opperating in Orong. The vegetable cooperative has a two year contract with the local high school that is expected to be renewed.

Vegetables available during late winter, prior to the monsoon, from March to May is somewhat limited and includes potatoes, chillies, radish, and beans mainly in abundance. Asparagus could be a vegetable that would be harvested during this somewhat food insecure period, adding nutritional diversity to the local school's meals. Furthermore, asparagus reportedly thrives well in areas with a similar dry sub-tropical climate and elevation as Orong (J. Gyeltshen, per. com.). Therefore, the objective of this pilot impact project was to establish an asparagus production trial as per the request of Orong's Agricultre Extension Officer (AEO) Pelden Tshomo. This project will fulfil three aims of the Sandrup Jongkhar Inititative (SJI; www.sji.bt/):

- Promote organic asparagus cultivation
- Improve households income through niche marketing
- Encourage the youth to continue farming

Relatives of *Asparagus officinalis* L., or cultivated asparagus, grow wild in the subtropical regions of Bhutan. This wild crafted asparagus commands a high price in parts of Bhutan. Dasho Rinpoche was the first to introduce a cultivated variety of asparagus around 1971 and later the Ministry of Agriculture started to promote plantings in western Bhutan (J. Gyeltshen, per. com.). Currently seedlings or crowns are available from Druk Seed in Paro.

Asparagus is extremely perishable, as optimum conditions for storage are $2^{O}C$ at 95% relative humidity. Market access is fairly good in Orong. A farm road connects to the Samdrup Jongkhar highway via Trashigang, allowing access to Dewathang and Samdrup Jongkhar within a half-day drive. Additionally, the construction of a new one-stop farmer

shop at Dengzor could serve as an excellent outlet for excess production not needed by the local school.

APPROACH

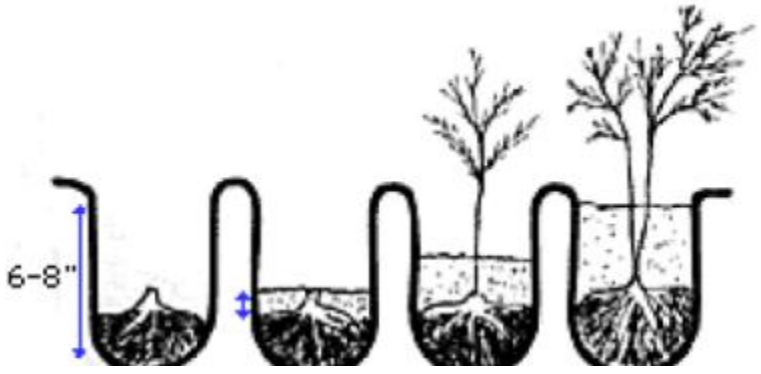
With 66,490 Nu. provided by the International Development Research Centre (IDRC), of Canada, and in collaboration with the District Agricultre Officer (DAO), the Agriculture Extension Officer (AEO) of Orong, and SJI farmer liasons, 15,500 one year old crowns were distributed to 31 households (500 each), at a cost of 4 Ngultrum per crown, but free for the farmer. The asparagus was provided by the Druk Seed research centre in Paro and the cultivar was Merry Washington, an open pollinated variety with a broad range of adaptation. Table 1. shows a detailed list of farmers who participated and the village they are from.

On 18th of July, 2014 the SJI liasons participated in a farmer field day facilitated by the AEO of Orong, Pelden Tshomo. The day started with trainings on planting crowns at farmer name Lobzang in Gonmenang. Pelden Tshomo (AEO) instructed farmers to prepare their land by incorporating compost to a depth of at least one foot and to make trenches like for planting potato, but not to cover the transplanted crowns with too much soil like for potato.

After a day of demonstration the farmers said, they had hope for this new crop. They were interested even though land preparation was hard work, because asparagus has the potential to yield for over 10 years and is relatively low maintanence, apart from annual weeding, adding compost, and harvesting. Their current annual vegetable crops are considered very labour intensive. Farmers over 60 years of age thought asparagus cultivation would give them more time for spiritual practice and be less physically demanding.

The method of planting asparagus as recommended by AEO:

- Asparagus is planted in early spring as soon as the soil can be worked.
- Select a site with good drainage, as asparagus doesn't like to have its roots flooded (Figure 1).
- Weeds are eliminated from the bed and a 2 to 4 in layer of compost manure is incorporated.
- Trenches of about 6 in wide and 6 to 12 in deep are dug (Figure 2).
- Plant the crowns (Figure 3) 15 to 18 in apart in the trench, spreading out the roots.
- Cover the roots and crowns with soil 2 in deep and water thoroughly.
- As the stems grow, fill in the rest of the trench



with soil, leaving 3 to 4 in of the stem exposed.

- Weeding is generally performed only two times per year.

Figure 1. Land preparation for planting asparagus.

Figure 2 Digging rows.

Figure 3 Asparagus crown.

Field evaluation 3rd February, 2015

The SJI farmer liasions visited two young asparagus plantations in Orong gewog (Figure 4). A field day was held in Layrong to discuss how the new asparagus plants were performing and Dr. Erik Landry attended to answer any questions the farmers had on asparagus production. Some farmers said that the crowns that they planted did not look as good as the ones at the demostration farm, and in the worst cases, very few grew at all. It became apparent that a few farmers were not confident in raising a perennial crop like asparagus, but when they brought up an issue the farmer promoters were quick to give advice. In most cases the advice provided by the farmer promoters was inline with Dr. Landry's recommendations.

It also became apparent that a few farmers were already experimenting or planning on saving seed from their plants to sell to other farmers interested in establising asparagus on their farms. M.C. Gurung, one of the members of the vegetables group said that, "seed is better for plantation even though it take time to grow compared to saplings. If the government provides saplings, more than 60 % die so farmers should sow seeds rather than plant crowns". Dr. Landry added, "locally produced seed will also reduce disease transmission and eventually lead to locally adapted asparagus". Some thought that the addition of fresh manure instead of compost could have caused low transplant success. There is a grub that apparently lives in the fresh manure and can damage young saplings. This should be looked into further and extension activities coordinated to disseminate any findings.

During the training, the participants were shown how to differentiate male and female asparagus plants based on flower structure, since it is dioecious. This was important because some plants will produce seed and others will not, however, both are need to

insure optimum seed set. The open-pollinated variety that they all received should have about 50% male and 50% female plants.

Figure 4. Left: Asparagus plantation in Layrong; Right: Asparagus spears in Morong.

LESSONS LEARNED

- Asparagus appears to grow well in Orong gewog.
- The low success rate of transplanted crowns at some farms could not be explained solely by crown quality. Although, some farmers may have planted sooner than others, management practices were not uniform across farms and may be the underlying issue for variable success rates.
- Higher and consistent success rates would have had a better chance if trainings were conducted at each farm helping with site selection, planting, and maintanence early, on an individual basis.

POTENTIAL FOR ECONOMIC DIVERSIFICATION AND UPSCALING

In Orong gewog there are three vegetables groups in Orong, Morong, and Nagzor. They were formed in 2008 and are quite successful. The vegetable groups have a contract with the local high school to provide fresh vegetables for the school's food program. Excess produce is marketed at the one-stop-shop and in markets in Dewathang and Samdrup Jongkhar. The AEO of Orong is confident saying, "if farmers put more effort in planting this asparagus it will be the main source of income for them since it is very expensive in the market". Also, M.C. Gurung, one of the farmer promoters, is planning on selling seed, which will help secure dependable seed free of any soil-borne diseases.

RECOMMENDATIONS AND GENERAL CONCLUSIONS

A valuable report specifically geared towards Bhutanese aspargus production was published by J. Gyeltshen. In this report he highlighted a number of important considerations that are not included above and should be made available to the asparagus producers in Orong. Excerpts from this report are highlighted here:

Site selection and preparation

- Exposed sites and frost pockets should be avoided.
- Choose a plot of land that has never been used for asparagus production before.
- There should be irrigation facilities.
- Look for a pH of around 6 (optimum is 5.9).
- Apply approximately 30 t/ha of organic manure before planting. Some dolomite limestone may be applied to increase pH and the magnesium level if necessary. Trenches should be filled with topsoil (5 cm), bone meal, and other organic manure in equal proportions.
- Consider sowing a green manure crop prior to planting to improve soil structure.
- For land that is on a slope it is advisable to make trenches horizontally along the slopes in a fish bone pattern depending on the steepness of the slope.
- Crowns can be planted up to a spacing of 45 cm; closer spacing gives higher yield, while wider spacing gives thicker spears.

During the final field day it became apparent that farmers were unsure about how to maintain an asparagus plantation and why certain practices were recommended. Below is a summary of the recommendations provided to farmers at the farmers' field day.

- The first two years will require irrigation to establish the asparagus plant. If the plant is actively growing and the soil is dry, irrigate to moisten the whole soil profile.
- From the third year on, harvest between April and June. A farmer can use irrigation to stimulate spear growth and restrict water to induce dormancy. Harvest should last ~4 weeks or until vigour declines. At this point allow the fern to develop and rejuvenate for the next season.
- Once ferns senesce (turn brown) during November and December cut and burn them to reduce disease transmission to the next season. Ridge soil and apply 5-10 cm of compost over the plants to improve spear quality and reduce the incidence of *Fusarium*.

Disease lesions on asparagus stems

Farmers were interested in saving seeds from their asparagus plants to both increase their plantation as well as to sell to other farmers. It was recommended during the seed saving workshop that only seeds from the best plants (early and vigorous spear emergence) should be saved to improve local adaption of the relatively unadapted cultivar originally supplied. Information regarding how to raise asparagus from seed can also be found in J. Gyeltshen's publication:

Propagation

- Asparagus is propagated through seeds, or vegetatively by means of crowns. Crowns give rise to new shoots. Asparagus crowns are grown from seed planted in a well-prepared seedbed where the plants are allowed to grow for one full growing season before being planted in the permanent bed. The quickest way to establish an asparagus crop is to plant 1-year old dormant crowns.

Nursery bed preparation

- Prepare a raised nursery bed after incorporating organic manure. Sowing time is from February to March. Soak seeds in warm water (32 C°) for 3 -4 days to hasten germination. Sow the soaked seeds in rows at a distance of 10 cm (4 inches) from seed to seed within a row and with a row-to-row distance of 30 cm (12 in). Sow in moist soil at a depth of 1.5 to 2 cm. Under dry and windy conditions, depth may be increased up to 5 cm (2 inches). Germination time is about 6 weeks and seedlings are very slow growing and susceptible to weed pressure.

Recommendations from farmer to the AEO

The farmers were generally appreciative of the free asparagus crowns but are looking for more trainings on how to be successful asparagus growers.

Recommendations from the AEO to the SJI

The AEO would like technical assistance with training farmers to save seed, since locally produced crowns would have less of a chance drying out prior to transplanting. The crowns from Paro were exposed for at least 5 days prior to transplanting.

Recommendations from the SJI to the AEO

- Keep dug crowns cool (about 4° C) and dry. High temperature, limited airflow, and humidity will cause rapid decay and will reduce transplanting success. Further individualized attention is advised for future activities.
- Seeds, rather than crowns, should be sourced due to the possible transmission of soil-borne diseases.
- Cultivars with low chill requirement should be acquired for the warmer regions of Samdrup Jongkhar. Jaleo (Vilmorin) is an all-male hybrid adapted to tropical (low-chill) environments and should be trialed.
- For seed producers, pollination is critical for seed set, so plant other flowers near the asparagus plantation to promote pollinating insects. Once the berries are bright red, harvest and macerate to remove the seeds. Soaking in water is effective for separating the pulp from seed. Once the seeds are washed and dried, store at low temperature and humidity.

Red asparagus berries with black seeds.

Table 1. Names and villages of participating farmers.

Farmer	Chiwog	Transplant success rate (%)
1. ‡	Morong	95
2.	Morong	90
3.	Morong	50
4.	Morong	30
5.	Morong	50
6.	Morong	50
7.	Morong	50
8.	Morong	80
9.	Morong	60
10.	Morong	50
11. ‡	Dengzor	80
12.	Dengzor	30
13.	Layrong	50
14.	Layrong	95
15.	Layrong	30
16. ‡	Layrong	97
17. ‡	Gonmenang	40
18.	Gonmenang	70
19.	Gonmenang	30
20. ‡	Nagzor	50
21.	Nagzor	40
22.	Nagzor	97
23.	Nagzor	20
24.	Nagzor	40
25.	Nagzor	40
26.	Nagzor	60
27.	Nagzor	50
28.	Nagzor	50
29.	Orong	20
30. ‡	Orong	50
31.	Orong	30

‡: Farmer promoter