Exploring Indigenous Knowledge and Production Constraints of Taro (*Colocasia esculenta* L. (SCHOTT)) Cultivars Grown at Dalbo Watershed, Wolaita Zone of South Ethiopia

By

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Research Article

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ABSTRACT

The maintenance and utilization of crop is important to ensure food security. To this effect a survey was conducted at Dalbo Watershed, Soddo district of Wolaita Zone, to describe and analyze the indigenous production methods. The survey was conducted in the selected villages of Dalbo Watershed namely; Dalbo Atwaro and Dalbo Wogene during the months of July, August and September 2006, thirty households from the two villages, among those who own taro crop were selected. A purposive systematic sampling technique is used. Method of data collection included individual interviews using structured questionnaire. Results of the study showed that taro farming at Dalbo Watershed was characterized by smallholdings with average family size of 6.96 people per household, average total farm size of 0.771 ha, and with an average farm size under taro production of 0.42 ha. A total of eight named taro cultivars were recorded on-farm. The number of cultivars maintained on individual farms ranged from one to eight (mean 3.08) and farmers decision regarding land use and number of taro cultivars to plant was influenced by the size of farm land, labour/household size, maturity, yield, taste and palatability of a particular cultivar. Local farmers recognized two categories of taro based on the ‘sex’ of the cultivars: “male” and “female” taro. Female taro mature early, are less vigorous, provide tasty and palatable corms as opposed to male taro. Most of the farmers had grown taro for more than ten years as a backyard crop, both for consumption and sale. Land preparation begins in November and most farmers plant taro in January. Harvesting usually begin ten months after planting, with majority of farmers harvest the yield between December to January. Farmers cited land shortage, shortage of capital, lack of oxen and improved farm implements and few others as the main constraints for taro production in the study area.

Keywords: Farmhouse hold, Indigenous production, taro, watershed.

1. INTRODUCTION

Indigenous knowledge is a store of experience and knowledge of an indigenous society on technologies, practices and beliefs that forms the basis for decision making to achieve stable livelihoods (Luka and Yahaya, 2012). Indigenous agriculturists or farmers have a wealth of knowledge on the production of crops in their communities that could be useful for a robust taro breeding program.

Taro (Colocasia esculenta (L.) Schott) is social and food security crop for millions of people in sub-Saharan Africa (Mulualem, 2012). It is cultivated, to a greater extent, to combat the food security threats of the increasing population (Regina et al., 2011). In Ethiopia, reliable information on production of taro is hardly known, but the crop is highly grown by rural households in different areas of the country for special purposes after the 1984 famine (Nebeyu, 2003; Mulualem, 2012).

Farmers in Ethiopia know different cultivars of taro and still consciously plant within their farmland for home consumption. In Wolaita, for instance, farmers have identified about eight taro cultivars locally named as Gerezua, Shishia (Yeda), Yiteria, Moli, Tawayia, Gessa, Dolka and Yeda, on the bases of variations in morphological, phonologic, agronomic and quality traits, its fitness into cropping systems and medicinal values (Simon, 1992). However, the existence of many vernacular names for the same cultivar, or vice versa has created problems to classification and conservation of cultivars while avoiding duplicates. Moreover, information on farmers’ indigenous knowledge on their production systems, diversity and selection of taro genotype scanty and not documented, and its attributes are unknown by scientific community and this limit the production and productivity of taro in the country. So, detailed analysis of farmers’ indigenous knowledge based on its grown cultivars has tremendous impact on the conservation and genetic improvement of the crop. This study was therefore conducted to explore robust, valid and reliable information for assessing the knowledge and
perceptions of farmers towards the indigenous production system, identify basic production constraints and selection of a taro cultivars found in Delbo water shade Wolaita zone.

2. MATERIALS AND METHODS

2.1 Description of the experimental sites

This study was conducted at Soddo district of Wolaita zone of southern Ethiopia. The area was selected based on high population pressure and long history of root crop production on Dalbo Watershed of Dalbo Atwaro and Dalbo Wogene peasant associations. Dalbo Atwaro is located at an altitude of 2,150 m.a.s.l., 6°54,006’ N latitude and 37°49,734’E longitude. Dalbo Wogene has an altitude of 2,314 m.a.s.l., and is found at 6°54,231’ N latitude and 37°48,562’E longitude. Dalbo Wogene is considered as a highland and Dalbo Atwaro peasant association as mid highland. It is located in the northeastern part of the Soddo district. The Dalbo watershed site was selected as representative watersheds for medium productivity potential in the Wolaita area and was used as experimental site for the Sustainable Rural Agricultural Development (SRAD) project funded by CIDA/UPCD in 2003. From the meteorological data of Sodo town, which is located within some distance of 6.5 kilo-meters northwest of Watershed, the Watershed has a humid climate with an average annual temperature of 20°C. Monthly mean temperature range from 17.2°C in July to 21.9°C in February. The average annual precipitation is about 1,333 mm with maximum and minimum recorded values of 29 mm and 218 mm in the months of January and July, respectively. Eighty three percent of the rainfall falls between April and October. The soils of the study area are developed on basaltic parent material. According to the FAO-UNESCO Soil Classification System, Eutric Nitosols are the dominant soil units of the Watershed (Ethiopian Mapping Authority, 1988).

2.2 Methods of data collection

Both primary and secondary data’s were used. Primary data was collected from sampled households through the designed questionnaires, and secondary data from concerned government and non-governmental institutions. Data were collected though in-depth interview of the farmers, using a structured questionnaire. Farm families, men and women, were interviewed at their farm. Data collected includes names and number of taro cultivars grown by farm households, and the key attributes of the cultivars and their uses, (using, for example, variety ranking as a tool), habitat for taro cultivation and management practices, cropping patterns (mixed, inter-cropping or mono-cropping), agricultural calendar, storage, utilization and handling, and problems on production, women’s participation on cultivation. The data were collected from June to September 2006 cropping season. The data collection was handled by using trained enumerators using local language.

2.3 Sampling scheme

Farmers were identified through a multi stage sampling design and farmers from each site were selected at random in consultation with office of agriculture. Thirty households were thus surveyed, 15 household heads from each peasant association.

2.4 Data analysis

The data analysis involved various descriptive statistics such as means, percent, and standard deviations were used. For each questionnaire, the percentage of farmers who gave similar response was calculated. Those who did not respond to certain questions were excluded from the calculation. Percentage of farmers in all peasant association who had given similar responses to a questionnaire was calculated based on the total number of farmers who responded to each questionnaire. Tables, graphs and figures were used to present summary statistics. The summarized variables include, household size and age structure, land holding size and land use pattern. Statistical packages (SPSS 1996) for windows version 12 was used for data analysis.

3 RESULTS AND DISCUSSION

3.1 Farming system characteristics of the study area

The farming system of the study area is characterized by subsistence mixed farming system of crop and livestock production. It is an area of intensive agriculture; where farming system combines growing of annual and perennial crops together with livestock. The number and types of crops grown by farm households varied across villages in the study areas; however; the minimum and maximum number of crops grown by individual farmers identified were 5 and 14, respectively. The first seven major crops grown as ranked by farm households across the study
villages are: enset (56.7%), wheat (33.3%), sweet potato (23.3%), Irish potato and maize (16.5%), beans (23.3%) and taro (23.3%) and are ranked based on their importance/contribution to household consumption (food security) (36.7%), source of cash (income) (6.7%) or both (56.7%), as shown in Table-1. This survey result indicated that, farmers at Dalbo Watershed placed taro within the first seven crops in terms of production, consumption and sell. The major factors governing the number and types of crops grown by particular farm households were the land holding size, number household members (labor availability), and presence of plough oxen.

Annual crops grown include cereals, pulses, vegetables, and root and tuber crops; however, vegetables such as carrots, beetroot, and cabbages are cultivated as cash crops in areas. Households obtain most of their cash income from sales of crop, livestock and livestock products, and in some cases casual employment. The opportunities for casual employment include local agricultural, urban and migratory work to places such as Awash and Metahara.

Production of annual crops covered 95% of the total farmland (excluding homestead gardens) of the villages followed by root and tuber crops. Majority of households (56.7%) cultivate enset at homestead gardens and most households heavily depend on this crop as their staples for their livelihood. While comparative data are not available, there are strong indications that sweet potato and taro in particular have grown in many areas of Wolaita Zone in recent decades, because, in addition to other advantages, both can grow in adverse conditions and require little inputs (Desalegne, 1996). According to Simon (1992), taro based specific survey result showed that about two in every three farmers in Wolaita grew taro.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Major crops</th>
<th>F</th>
<th>P</th>
<th>Size of farmland (ha.) (N=30)</th>
<th>Household size (N=30)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mean</td>
<td>St. dv.</td>
</tr>
<tr>
<td>1</td>
<td>Enset</td>
<td>17</td>
<td>56.7</td>
<td>0.801</td>
<td>0.61</td>
</tr>
<tr>
<td>2</td>
<td>Wheat</td>
<td>10</td>
<td>33.3</td>
<td>0.75</td>
<td>0.57</td>
</tr>
<tr>
<td>3</td>
<td>Sweet potato</td>
<td>7</td>
<td>23.3</td>
<td>0.58</td>
<td>0.28</td>
</tr>
<tr>
<td>4</td>
<td>Potato</td>
<td>5</td>
<td>16.7</td>
<td>0.45</td>
<td>0.33</td>
</tr>
<tr>
<td>5</td>
<td>Maize</td>
<td>5</td>
<td>16.7</td>
<td>0.93</td>
<td>0.85</td>
</tr>
<tr>
<td>6</td>
<td>Beans</td>
<td>7</td>
<td>23.3</td>
<td>0.95</td>
<td>0.61</td>
</tr>
<tr>
<td>7</td>
<td>Taro</td>
<td>7</td>
<td>23.3</td>
<td>0.42</td>
<td>0.14</td>
</tr>
</tbody>
</table>

F=Frequency, P=Percentage of farmers, St. dv. =Standard deviation

Table-1: The seven major crops as ranked by farmers, their relative proportion and relation with household characteristics.

3.2 Household characteristics of taro producing farmers at Dalbo Watershed

The average family size of sample farm household was estimated to be 6.96 people per household. The minimum and maximum family sizes were found to be 1 and 20, respectively. This result was similar to the previously reported results that the average family size is 6.7 persons per household, ranging from 3 to 12 persons (CSA, 2003). The bigger family size was due to the existence of polygamy among some people in the area.

The majority of the farmers had long time experience of farming. Mean number of year of farming experience was 27.9 with minimum of 3 and maximum of 70 years. About 77.1 % of the interviewed farmers had been growing taro for more than ten years, 12.4 % between 5 to 10 years and 10.5% had less than five years of experience of growing taro.

Land holding per household in the study communities of Dalbo Watershed are generally small because of high population density, rarely exceeding one hectare and the average land holding size per household was 0.771 ha. The minimum and maximum land holding size was 0.25 hectare and 2.5 hectare, respectively (Table-2). Farmers utilize their limited land for cultivating annual and perennial crops, grazing and planting trees. Farmers at Dalbo Wogene have relatively larger land holding size than farmers at Dalbo Atwaro; thus farmers at Dalbo Wogene allocated relatively larger land area for crops such as enset, yam, taro, coffee and fruit crops than farmers at Dalbo Atwaro (Personal observation).
Among the sample household heads interviewed, 83.3% of farmers reported that taro was the most important food staples and frequently grown by the family year after year, but only 16.3% of farmers considered taro a less important crop and grow it occasionally on their farm. Thirty percent of the farmers were producing taro only for home consumption and 70% of them produced for both consumption and sale when surplus.

3.3 Management practices for annual cultivation of taro

Land preparation and planting: According to the farmers, land preparation for taro production was the most difficult and labor intensive activity, because before planting the crop, the soil should be plowed up to the maximum of seven times, but the majority of farmers (33.3%) plow four times with an interval of 15-20 days. This frequency of land preparation can be reduced if oxen are not available for a given household head or soil moisture is not favorable. Majority (63.3%) of farmers grow taro as a backyard crop around homestead, 23.3% in farmland, only 10% in both fields and plowing of the land can be done with oxen drawn ploughs (76.7%) and locally made traditional farm implements (23.3%), which includes Tikia, Shilikia and Ayilia. Those households who do not have oxen, exchange manual labour for oxen power or set up a sharecropping arrangement.

Land preparation usually starts in November. Under normal circumstances, land preparation is carried out when the soil is still moist enough to meet the requirements of taro for loose and deep soil. However, planting is usually delayed until January before the onset of dry season so that the young plants can make use of remaining soil moisture from the preceding season. The information from the District Office of Agriculture, group discussion of selected farmers in the and development agents of the area, planting operation for taro begins at onset rains. About 53.3% of farmers in the area plant taro in ‘January’ month, 26.6% plant in ‘February’ and about 10% plant between ‘January’-‘February’ months depending on the availability of moisture and the remaining 3.4% plant taro other than these months either as early as ‘December’ or months later than ‘February’. Almost all farmers plant taro in rows on a flat land (93.3%), so as to allow cultivation between rows, to remove weeds, loosen the soil and to earthen up newly emerging tubers; and planting on mounds or ridges was not as such common in the area, but practiced rarely (6.7%) by farmers for irrigated lands. Based on spacing majority of farmers (66.7%) use about 50 x 50 cm spacing, this agrees with the recommendation of research 16.7% of farmers used 50 x 75 cm spacing, and they thought that it was convenient for obtaining good yields.

Planting materials: Farmers propagate taro vegetatively from the mother plant. The conventional planting materials utilized by farmers at the study sites include corms (13.3 %), cormels (13.3 %), corm pieces (16.7%), or combination of corms, cormels and corm pieces (56.7%), however, corms and cormels display a dormancy period of about three-five weeks, during which sprouting does not occur. Farmers use their own traditional techniques to break dormancy in taro. They spread the corms or cormels after harvest in the sun for few days, this breaks the dormancy. There is no formal seed supply system nor do farmers specialize in producing taro-planting materials in the area. Most (75%), (47.6%), (37.1%) and (12.4%) of the farmers obtained planting materials from their own farms, their own multiplication plot around homesteads, their neighbors and market source respectively.

Weeding: Farmers did not consider weeds to be an important problem for taro production at Dalbo Watershed. However, taro plant is susceptible to weed competition, especially during the first 3-4 months after planting, and weed control is a beneficial cultural practice at this stage of the growing period (Purseglove, 1972). During this time, either ox drawn implements (80%) or locally made hand tools (20%), like Ayilia, Shilkia, Tikia, and Zabia can be used for weed removal depending on the size of farmland allotted for the crop.

Manuring: No farmer has reported the use of mineral fertilizer for taro production at Dalbo, almost all of the farmers grow around homestead as a backyard crop and use organic fertilizers like household refuses/wastes or composts (33.7%) and manures (63.3%) to improve the fertility status of the soil. Manure is incorporated into the soil either during land preparation, before planting (10%), at planting (26.7%), from planting to 150 days after planting (50%), or at any other time (13.3%) to maintain soil fertility.

### Table-2: Differentiation among household sizes, landholding size and farming experience at Dalbo Watershed.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Dalbo Wogene Mean</th>
<th>SE</th>
<th>Range</th>
<th>Dalbo Atwaro Mean</th>
<th>SE</th>
<th>Range</th>
<th>Total Mean</th>
<th>SE</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household size</td>
<td>6.2</td>
<td>0.65</td>
<td>9.0</td>
<td>7.73</td>
<td>1.02</td>
<td>16</td>
<td>6.97</td>
<td>0.61</td>
<td>19</td>
</tr>
<tr>
<td>Land hold size</td>
<td>0.92</td>
<td>0.19</td>
<td>2.25</td>
<td>0.62</td>
<td>0.066</td>
<td>0.75</td>
<td>0.77</td>
<td>0.11</td>
<td>2.25</td>
</tr>
<tr>
<td>Farming experience</td>
<td>26.5</td>
<td>3.25</td>
<td>46.0</td>
<td>29.26</td>
<td>4.26</td>
<td>58</td>
<td>27.9</td>
<td>2.64</td>
<td>67</td>
</tr>
</tbody>
</table>

Among the sample household heads interviewed, 83.3% of farmers reported that taro was the most important food staples and frequently grown by the family year after year, but only 16.3% of farmers considered taro a less important crop and grow it occasionally on their farm. Thirty percent of the farmers were producing taro only for home consumption and 70% of them produced for both consumption and sale when surplus.
The majority of taro growers in the Asia/Pacific region, especially those producing taro for subsistence, do not use any fertilizer. Some believe that fertilizers diminish the quality and storability of their taro (Onwume and Sinha, 1999).

3.4 Cropping system

**Intercropping and crop rotation:** Almost all farmers reported that they did not practice inter-cropping for taro production and it is established in monocropping at homestead. Only rarely few farmers (3.3%) practice intercropping maize in wider spaces in between taro plants. However, this was only done as the crop approaches maturity. The majority of farmers (96.7%) practice crop rotation practices in the area, since land shortage forced them to use it. Farmers during group discussion gave many reasons why they used crop rotation; it improves soil fertility (23.3%), reduce pest attack (3.3%) and give good yield (70%) for the crops grown in rotation. The crop rotation pattern observed in the area was cereals (tef, wheat and maize) then pulses (beans and field pea) followed by root crops (sweet potato, potato, yam, and others). Farmers also did not grow taro in succession on the same field.

**Crop protection:** During the survey, farmers were asked to identify major pests and diseases affecting taro production in the area. All farmers responded that production of taro in the villages currently is free from pest and disease attack. But during field visit, we observed symptoms similar to taro leaf blight observed on some farmers taro plots and the symptoms were characterized by the appearance of circular moist spots on the leaf of the plant prior the collapse of the leaves and it was common for plants grown in swampy areas.

**Maturity, harvesting and storage:** Farmers at Dalbo Watershed identified that the majority of taro cultivars (70%), existing in their hands mature and become ready for harvesting between 10-12 months after planting with the exception of two cultivars namely tawayia and Yeda, which are relatively late maturing cultivars and do not show any sign of maturity where the other cultivars are harvested. These cultivars stay on the field for more than a year as described by farmers. The time from planting to harvest varies with genotype and method of cultivation. Farmers at Dalbo practice different types of harvesting mechanisms, once-over (20%), piecemeal (73.3%) and progressive (6.7%). Another important merit of taro production in Wolaita is the possibility of having two different harvesting stages of the crop. Systematic harvesting involves harvesting of the cormels by detaching from the mother plant at a given immature stage of the plant leaving the mother plant until maturity (Simon, 1992). This practice is done to fill seasonal food and economic gaps when other crops are not in the field. Harvesting usually occurs during the dry season with the majority of farmers (86.7%) harvesting taro between October to December; only 13.3% of farmers harvest taro at Dalbo in January. Once harvested, most of the tubers serve for household consumption (53.3%), sold immediately after harvest as a source of cash income (30%), or saved as a planting material for the next year planting (6.7%). Relatively rich farmers sell taro in the field to traders who harvest, pack up and transport it to markets. The main channel of taro marketing in the area is ‘producer-assembler-consumer.’ Perish ability of the tubers; storage problems and high transport cost are the major marketing problems of taro in the study area. In the area farmers use five kinds of traditional storage practices for taro. These include: A) Storing the yield (corm and cormels) in a pit; About 10% of the farmers used this practice, B) Storing on well prepared bed or ‘Kot;’ It is common and 53.3% of farmers utilized this practice, C) Leaving the yield (corm and cormels) underground until they are used. About 10% of the farmers used this practice, D) Spreading the yield under the bed in the house; 10% of the farmers adapt this method; E) Use of separate storage house for storing the tubers; 13.3% of farmers used this method. In general, these traditional storages were efficient, cost effective and simple.

3.5 Gender role in taro cultivation:

Men are responsible for the major work (90%) in taro cultivation while women are responsible for some work (10%) like processing, selection culinary use and maintenance of planting materials (Admasu, 2002). Women and development study in Southern Nations and Nationalities verified the fact that women participated in crop and livestock production as they share 33-37 % of the crop production (FAO, 1990).
Table 3: Gender role in taro production at Dalbo watershed in Wolaita zone.

<table>
<thead>
<tr>
<th>Activities</th>
<th>Responsibility</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Men</td>
<td>Women</td>
<td>Both</td>
<td></td>
</tr>
<tr>
<td>Land preparation</td>
<td>30</td>
<td>100</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Planting</td>
<td>28</td>
<td>93.3</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Weeding</td>
<td>24</td>
<td>80</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Harvesting</td>
<td>23</td>
<td>76.7</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Processing</td>
<td>1</td>
<td>3.3</td>
<td>28</td>
<td>3</td>
</tr>
<tr>
<td>Decision on income obtained from sell of tubers</td>
<td>19</td>
<td>63.3</td>
<td>5</td>
<td>16.7</td>
</tr>
<tr>
<td>Selection and maintenance of cultivars</td>
<td>0</td>
<td>0</td>
<td>27</td>
<td>90</td>
</tr>
</tbody>
</table>

F = Frequency, P = Percentage

3.6 Production constraints and management practices of taro at Dalbo Watershed

Group of farmers were selected as key informants from the study areas and was asked to identify and prioritize the major problems limiting taro production. The group identified and ranked the problems. Land shortage was the first major problem constraining taro production in the area, was reported by 60% of the group followed by shortage of capital (money) to buy farm inputs, lack of oxen and improved farm implements that limits adequate land traction, erratic rainfall and its associated dry spells, shortage of labor, decline in soil fertility, inadequate supply of planting materials and low yielding potential of local cultivars.

4 SUMMARY AND CONCLUSION

The study was initiated to analyze the indigenous production practices of taro and to access farm based taro diversity in Wolaita with the ultimate goal of bringing the crop to the attention of researchers and policy makers through broadening the knowledge base of the crop. Towards this effort, a farm-level survey was conducted that covered thirty households from selected villages of Dalbo Watershed.

Taro farming at Dalbo Watershed was characterized by small land holding size, using a few of widely distributed cultivars that are perceived to be superior with respect to a number of attributes described by farmers. A total of 8 named cultivars were recorded on-farm at the two villages. The number of cultivars maintained on individual farms ranged from one to eight (mean 3.08) and farmers decision regarding land use and number of taro cultivars to plant was influenced by the size of farm land, maturity, yield, taste and palatability of a particular cultivars. Local farmers recognized two categories of taro based on the ‘sex’ of the cultivars: “male” and “female”. Female taros mature early, are less vigorous, provide tasty and palatable corms as opposed to male taros. The majority of farmers grow taro as a back yard crop. Land preparation begins in November and most farmers plant taro in January. Harvesting usually begin ten months after planting, with majority of farmers harvest the yield between December to January. Similarly, the result of this study demonstrates that the active participation of women in taro production mainly focus on weeding, harvesting, processing, marketing and selection and maintenances of cultivars. Farmers cited land shortage, shortage of capital, lack of oxen and improved farm implements and few others as the main constraints for taro production in the study area.

5 REFERENCES


