Domestication of Indigenous Trees As A Sustainable Way of Improving Rural Livelihoods

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Abstract: Domestication of indigenous fruit trees is one of the best ways to follow as this improves human livelihoods in most rural areas. Domestication contributes to genetic richness in the community and promotes entrepreneurship to youth and old aged people. The research targeted Sclerocarya birrea and Ziziphus mauritiana from Chivi and Mt Darwin. The aim of the study was to identify benefits of domestication indigenous trees and how do they contribute to rural livelihoods. Participants were selected using stratified random sampling to allow a mixture of age and gender balances. Interviews were done individually to allow participants time to give their full ideas. Sixty (60) participants were interviewed from both areas combinable. The results shows that most people (93.3%) benefited from Marula in form of wine and 100% of participants in Mt Darwin benefit raw fruits form Ziziphus mauritiana and they sell the fruits either raw or processed to get income which they will use to buy foods and other resources needed in their day to day lives. Domestication of indigenous fruit trees contribute immensely to human livelihoods. There is need for government to do economic valuation of these resources and come up with policies which promote domestication of indigenous fruit trees such as Marula as they can contribute a large portion of rural livelihoods.

Keywords: Domestication, Indigenous trees, Livelihoods, Sclerocarya birrea & Ziziphus mauritiana.

1. Introduction
Domestication is one of the factors which contribute to genetic richness in agroforestry germplasm (Leakey, 2005). Domestication of agroforestry tree is enhancement of stability and productivity of agro-ecosystems by diversifying on-farm species composition (presence and abundance). Domestication is one of the pillars contributing to genetic richness in agroforestry germplasm, because agroforestry species will be under monitoring from human beings (Leakey et al., 2004). A good example is domestication of Sclerocarya birrea in Zvishavane where the tree is under threat from local people because it produced good quality wood for carving to produce carved products such as kitchen utensils, chairs, plates and drums which have international market (Ngorima, 2006; Leakey et al., 2005). Domestication of Sclerocarya birrea tree contribute to genetic richness of Sclerocarya birrea germplasm and its domestication are now spreading to other areas because it’s profitable since farmers harvest marula fruits produced oil which is profitable to human life (Leakey and Page, 2006).
2. Review of literature

Domestication of agroforestry species such as Azanza gakeana, Adansonia digitata, Jacaranda mimosifolia and Uapaca kirkiana improves species richness of the trees because their population will increase and they are now monitored and some may even manage them well so that its genetic material can be passed on from one generation to another (Leakey et al., 2003; Leakey et al., 2004). Domestication of Sclerocarya birrea is a good contribution way to genetic richness because, the tree is dioecious (male and female flowers on different trees) (Leakey, 2005). This cause propagation/reproduction of a tree to become difficult, hence if such a tree on its own dies up, no other genetic material from such a tree will be obtained (Leakey and Tomich, 1999).

Sclerocarya birrea is under threat from grazing animals because when seedlings, grow under tree are commonly destroyed by grazing or cultivation in farmlands. The tree is under threat from agricultural expansion, overgrazing and exploitation for other uses such as carving (Ngorima, 2006). Urgent conservation and management of remnant populations improves species richness leading to genetic richness in agroforestry germplasm (Sclerocarya birrea germplasm). Since Sclerocarya birrea seeds are orthodox, are maintained in seedbank collections, to improve its sustainability. In Africa, Domestication Sclerocarya birrea is well done in Burkina Faso, Kenya, Tanzania and Togo (Leakey et al., 2005). In these countries they have Sclerocarya birrea feed centres. Most countries in Africa which are now practising domestication of the tree collect seeds from these countries (Moss, 1995; Leakey et al., 2005; Leakey, 2005).

Domestication of the tree is done because it is unknown whether the tree can be found in protected areas such as national parks (Botanical gardens) (Leakey, 2005). Domestication and selection is done so that all or most Sclerocarya species can be used on same plots (farm lands) to improve species richness so that best genomes can be kept for future use Sclerocarya birrea on farm lands produces more fruits than on natural woodlands (Leakey and Newton, 1994). The tree has high potential for domestication and the programme has been run by World Agroforestry Centre (ICRAF) since 1995 to benefit subsistence farmers in Dryland agroforestry systems (Moss, 1995).

The trees can be grafted so that programme increases product uniformity, productivity and foster conservation of the germplasm. Genebanks should aim to establish collections covering the whole species range so that full range of genetic variability species can be captured. Natural regeneration in farmlands is encouraged to retain original germplasm so that genetic variation is preserved. Domestication of bush mango (Irvingia gabonensis) an indigenous fruit tree which is suitable for agroforestry (Moss, 1995; Leakey and Newton, 1994). Since I. gabonensis is among the Cinderella species that are ideal agroforestry trees. The tree can be domesticated because it is already recognised by local people in The Central African Region. The tree can be domesticated to improve its genetic richness (species richness) because they are found in some areas and some not (Leakey et al., 2003; Leakey et al., 2004).

Domestication of I. gabonensis and I. wombolu improves its genetic variation and provides a wide base for agroforestry germplasm management (Moss, 1995). In Gabon, Cameroon and Nigeria; they have genebanks (live) for I. gabonensis and I. wombolu containing seeds which are largely considered by farmers (Leakey et al., 2005). These germplasm collections with help of knowledge of the genetic variation of Irvingia species allow genotypic selection of individuals for vegetative propagation to promote domestication process (Leakey and Tomich, 1999).

Most of trees in Agroforestry which are domesticated are Strychnos cocculoides, Parinari curatellifolia, Ziziphus mauritiana, Syzygium cordatum because farmers protect indigenous tree so that their germplasm remains viable and available for long time (Mateke, 2000; Kwegiga et al., 2000; Akininvesi et al., 2004a, b). Tree domestication selects and improves germplasm of indigenous tree. The aim of the study was to identify benefits of domestication indigenous trees and how do they contribute to rural livelihoods.

3. Methodology

The study was carried out in Chivi and Mutoko where most of the identified species were common. The objectives of the research were introduced to village headman to seek permission to carry out the experiment. Three villages were selected in Chivi and three in Mutoko using stratified
random sampling. Sixty participants were interviewed in Chivi from a total population of 200 villagers. This marks 30% of the total population who were selected. Thirty percent of villagers in Mutoko were also selected making a sample of 30 participants from a population of 100 households in the villages chose for research. Participants were also chose using stratified random sampling were they were grouped using their ages to make sure all age categories form 16 years were selected. Participants were interviewed individually to avoid interference of results from other participants. Focus group discussions were also done using participatory rural appraisal to allow all participants to give their information about selected species. Sclerocarya birrea, Uapaka kirkiana and Ziziphus mauritiana were the targeted species. Questionnaires were used to allow confidentiality. These questionnaires were containing both open and close ended questions. Questionnaires were pilot tested to make enumerators to be familiar with it and to allow for adjustments in the questions.

4. Data Analysis

Data was subjective to analysis using Analysis of (ANOVA) using IBM SPSS 25 to obtain means, standard deviations and graphs.

5. Results

5.1 Contribution of S. birrea to human livelihoods

*Sclerocarya birrea* is one of the major trees which is being underutilised in most marginal areas. In Chivi most farmers use the tree to obtain fruits, raw nuts, juice, edible worms, fruit skins to produce soda and fermented juice which they use as wine. Nuts are used to produce peanut butter which will be used by people as a substitute of cooking oil. Most (93.3%) participants indicated that fruits from *S. birrea* are very important in most marginal rural areas as it is used as source of income. Interviewed participants indicated that Marula fruits can be used to produce juice which will be fermented to wine and sold to generate income.

<table>
<thead>
<tr>
<th>Contribution</th>
<th>Frequency (N=60)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nuts</td>
<td>45</td>
<td>75.0</td>
</tr>
<tr>
<td>Wine</td>
<td>56</td>
<td>93.3</td>
</tr>
<tr>
<td>Soda</td>
<td>24</td>
<td>40.0</td>
</tr>
<tr>
<td>Snacks</td>
<td>38</td>
<td>63.3</td>
</tr>
<tr>
<td>Medicine (leaves, bark and roots)</td>
<td>50</td>
<td>83.3</td>
</tr>
<tr>
<td>Edible worms</td>
<td>47</td>
<td>78.3</td>
</tr>
<tr>
<td>Carving</td>
<td>12</td>
<td>20.0</td>
</tr>
</tbody>
</table>

From Table 1 results show that wine is a major contribution to human livelihoods where some sell it to get money for paying school fees, some use wine as mode of payment for cultivation/weeding of their crops. Only 20% indicated that carving contributes to human livelihoods and there are only few people in Chivi who are in carving business.

5.2 Contribution of Z. mauritiana to human livelihoods

From the results, participants indicated that they use Z. mauritiana to produce wine which they sell to get money. They indicated that other people are getting income from selling wine although some indicated that the wine is not recommended here in Zimbabwe. Most (80%) of the participants indicated that buyers came from as far as Harare to buy the fruits. Only few (20%) indicated that they sell raw fruits at Mbare Musika and they use money to buy groceries and clothes. Farmers in Mt Darwin indicated also that there is a lot of income from these fruits since some individual drive from Harare with groceries such as sugar and flour to pay for the fruits. No one indicated the medicinal benefit from Z. mauritiana trees as no evidence was indicated. Contribution of Z. mauritiana to human livelihoods is one of major importance in improving rural livelihoods after selling the fruits to several consumers. The results are shown in Table 2 below.

Table 2: Contribution of Z. mauritiana tree to human livelihoods as viewed by participants

<table>
<thead>
<tr>
<th>Contribution</th>
<th>Frequency (N=30)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw fruits</td>
<td>30</td>
<td>100</td>
</tr>
<tr>
<td>Wine</td>
<td>24</td>
<td>80.0</td>
</tr>
<tr>
<td>Snacks</td>
<td>24</td>
<td>40.0</td>
</tr>
<tr>
<td>Money after selling fruits</td>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td>Sugar and flour</td>
<td>25</td>
<td>83.3</td>
</tr>
</tbody>
</table>

All participants interviewed indicated that they eat raw fruits and during the season when the fruits are abundant they substitute afternoon meals with the fruits. This reduces costs of buying food for lunch and they rather channel money for other uses.

6. Discussion

6.1 Contribution of S. birrea to human livelihoods

These results coincides with results found in South Africa (Bushbuckridge) where most unemployed women produce juice from Marula and sell on road sides (Shackleton and Shackleton, 2005). Results from the findings show that farmers who live in areas where Marula trees are dominant in fields collect ripe fruits and extract juice, dry Marula fruit skin to produce soda which they later sell to get income. One of the interviewed participant indicated that he got US$300 per month after selling wine from Marula and got $120 after selling nuts. This also coincides with results from Namibia where farmers collect fruits after seeking permission from the headman and produce wine for sell (Mojeremane and Tshwenyane, 2004). Table one below shows contributions of Marula tree to human livelihoods. These findings also coincide with findings by (Leakey, 2005; Du Plessis, 2002) in Namibia.
6.2 Contribution of *Z. mauritiana* to human livelihoods

These results coincide with findings by (Kwesiga *et al.*, 2000; Akinnifesi *et al.*, 2004a). Akinnifesi *et al.* (2006) reported that a lot of fruits obtained from indigenous trees have closer to 90% offtake. This coincides with the results of this research were 100% of participants indicated that *Z. mauritiana* fruits are consumed as raw with some being sold to raise income used for fees payment and some raw fruits used to produce snacks and wine (Leakey, 2005). Farmers can obtain edible insects from *Z. mauritiana* tree such as lac insects (Yogi, Jaiswal and Sharma, 2017).

7. Conclusion

Marula and *Z. mauritiana* trees contribute immensely to human livelihoods but there is need for government to establish policies which promote domestication of indigenous fruit trees which have economic values to people. Another major challenge which leads to poor success of researches about domestication of fruit trees is lack of economic valuation of fruits from indigenous trees here in Zimbabwe. If these products are being valued and their economic valuation is done government and other stakeholders will see the importance of these trees and promote their domestication. Marula fruits have greater opportunity to improve rural livelihoods if the tree is domesticated and increase in fruit harvests increases. This may provide opportunity to local breweries to engage local people in wine production thereby creating employment. Lack of decortication machines also affects farmers to produce large quantities of nuts for peanut butter production as well as oil extraction.

8. Recommendations

- Marula fruits must be used for the production of butter, wine, soda and snacks.
- Marula branches can be used for carving, bark can be used for medicinal purposes and forming dye if they are moist.
- *Ziziphus mauritiana* fruits can also be used for production of wine, snacks, raising fees after selling them as raw fruits.

9. References


