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Technical Skills Required in Production and Processing of *Moringa olifera* Leaves into Powder for Improving Health Status of Rural Families in Enugu State of Nigeria

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Abstract

The study identified the technical skills required in production and processing of *Moringa oleifera* leaves into powder. Four research questions and four null hypotheses guided the study. A structured questionnaire of 76 items was used to elicit response from 40 respondents comprising 30 Crop Science Lecturers and 10 Agricultural Education Lecturers. The instrument was face validated by three experts and Cronbach alpha reliability test which yielded a coefficient of 0.79 was used to establish the internal consistency. The data collected were analysed using Mean to answer the research questions and z-test statistic to test the null hypotheses at 0.05 level of significance. The findings of the study revealed the technical skills required site selection, climatic requirements and land preparation, planting and post planting of Moringa, harvesting of Moringa leaves and processing of Moringa leaves into powder. Based on the findings, it was recommended among others that the identified technical skills should be applied by the rural families for the production of *Moringa oleifera* leaves for their benefit.

Key Words: Production, Families, Processing, Moringa leaves, Skills, Health status.

Introduction

Moringa oleifera is a tree crop known throughout the tropics. It is a versatile plant that can grow as a perennial vegetable under intensive cultivation. Moringa trees can grow up to 4m(15ft) a year reaching a height of 15m(50ft) and can live for approximately 20 years(Doerr and Cameron,2005). It is known for human food, livestock forage, medicine, dye and water purification. Palada and Chang (2003) stated that *Moringa Oleifera* leaves have more beta-carotene than carrots, more protein than peas, more vitamin C than oranges, more calcium than milk, more potassium than bananas, and more iron than spinach.

Almost every part of Moringa plant has nutritional values. According to Sauveur and Broin (2010) *Moringa oleifera* leaves are eaten as greens, boiled, fried, in soup or for seasoning. Dried leave powder can be added to any kind of meal as a nutritional supplement. The seed can be roasted and eaten like a peanut. Leaves and young branches are used as fodder. Radovich (2011) noted that press cake left after extracting seed oil is utilized as a fertilizer and as a flocculent for water clarification. The author stated that seed cake contains positively charged compounds that are effective in settling suspended solids out of water(flocculation) because most particles have a net negative surface charge while suspended in aqueous solution. The oil is edible and it is becoming popular in the cosmetic industry (Sauveur and Broin).

According to Newton (2006), Moringa grows best between 25 to 35^{o}c, but will survive up to 48^{o}c. The drought tolerant tree grows well in areas receiving annual rainfall range from 250 to 1500mm. The author stated that *Moringa oleifera* prefers a well drained sandy loam or loamy soils and a ph range between 5.0 to 9.0. These conditions signify that Moringa production is favoured in Enugu State.

Moringa oleifera production involves the cultivation of the plant to get its products such as leaves, seeds, pods, roots among others. Production according to Oji(2002) is the process whereby some goods and services called inputs are transformed into other goods and services called output or product. The author stated that many types of activities are involved in the production process. Moringa production therefore requires a fertile land, seeds and seedlings, manure, herbicides, labour, technical skills of the management, among others as the inputs. The products obtained from Moringa production are processed to increase the value of the products. Processing according to Pearson in Ukonze and Ifeanyieze (2012) involves making of food, materials or goods ready to be used or sold, for example through preservation or improving them in some way. Therefore, processing of Moringa leaves involves the transformation of the leaves into powder. In processing of Moringa leaves, Sauveur and Broin (2010) stated that the leaflets should be stripped out of the petiole and wash thoroughly with clean portable water to remove dirt. Though Moringa leaves can be eaten fresh, Moringa powder can stay for a long period of time without losing its efficacy provided it is stored dry and under normal temperature. This was supported by Doerr and Cameron(2005) who noted that Moringa leaf powder should be stored in air-tight containers protected from heat, humidity and light. The authors stated that if the powder is not adequately dried or stored, it could encourage the growth of moulds or mildews which could cause problems ranging from unpleasant to harmful. If stored powder is exposed to heat or light, it will degrade and the nutrient content will be reduced. Hence, one needs to acquire the technical skills in Moringa leaf production and processing before venturing into it.

Technical skills are the manipulative skill required to do something correctly. Hippel (1988) stated that technical skills are the accumulated practical expertise that allows one to do something smoothly and efficiently. Skills according to the Executive Committee and Council of Presidents of Melbourne(1974) is the knowledge and experience of a technical, commercial, administrative, financial or other nature, which is practically applicable in the operation of an enterprise or the practice of a profession. Technical skills in *Moringa oleifera* production and processing is therefore the practical knowledge inherent in the production and processing of the plant and its products which one requires to acquire so that he can produce and process it efficiently. These include the practical skills required in soil selection, climatic requirement and land preparation, planting, post planting, harvesting and processing of *Moringa oleifera* leaves into powder. These practical skills are possessed by the Agricultural Education Lecturers and Crop Science Lecturers of Universities. Agricultural Education Lecturers of Universities are the teachers that implement agricultural education curriculum in Universities. Osinem (2008) stated that a Lecturer is any teacher that is trained in the knowledge and skills of the subject matter as well as in the methodology of imparting the acquired knowledge and skills to the students in the university. Agricultural Education Lecturers and Crop Science Lecturers are therefore the teachers trained in the knowledge and skills of crop production and processing including *Moringa oleifera*, as well as on the methods of imparting the knowledge and skills to the students. Moringa provides cheap source of medication to the rural families.

Rural families are the fathers, mothers and their children living in non-urban communities. These families are mainly farmers that operate at subsistence level. As a result, they live below the poverty level and are subject to a lot of health problems. Mungall in Wood and East(2004) stated that there are a number of illnesses that are particular to rural populations and are more likely to be treated only by rural practice. The authors noted that rural communities generally face poor access to healthcare services. Redovich(2011) reported that *Moringa oleifera* leaf powder is noted for its medicinal value. The author stated that the most common direct medicinal use of the plant is as poultice of the leaves and can be applied directly to wounds as anti-microbial and to promote healing. The anti-fungal and anti-bacterial properties of Moringa extracts are well known and are thought to be derived at least in part from 4-(α-L-rhamnopy-ranosyloxy) benzyl isothiocyanate. The author stated that work at Johns Hopkins University is supporting traditional use of Moringa to treat cancer.

Allison(2005) identified low income or poverty as one of the most significant barrier in assessing healthcare among rural families. Some rural families do not attend hospital for proper diagnosis and treatment when they are sick only because they do not have the money to pay for the hospital bills. This is one of

the reasons Amagloh and Benang(2009) reported that such families resort to sources such as dams, dug outs, streams, rivers and lakes. The authors noted that water from these sources is usually turbid and contaminated with micro-organisms that may cause many diseases including guinea worm and bilharzias. Hence, the need to identify the technical skills required in production and processing of *Moringa oleifera* leaves into powder for improving health among rural families in Enugu State.

Purpose of the Study

The general purpose of the study was to identify the technical skills required in production and processing *Moringa oleifera* of *Moringa oleifera* leaves into powder for improving the health status among rural families in Enugu State of Nigeria. Specifically, the study determined the technical skills in:

1. soil selection, climatic requirements and land preparation of *Moringa oleifera*.
2. planting and post planting of *Moringa olifera*.
3. harvesting of *Moringa oleifera* leaves.
4. processing of *Moringa oleifera* leaves into powder.

Research Questions

The following research questions guided the study.

What are the technical skills required in:

1. soil selection, climatic requirements and land preparation of *Moringa oleifera*?
2. planting and post planting of *Moringa oleifera*?
3. harvesting of *Moringa oleifera* leaves?
4. processing of *Moringa oleifera* leaves into powder?

Hypotheses

The following hypotheses formed the basis of the study and were tested at 0.05 level of significance.

There is no significant difference in the Mean responses of Crop Science Lecturers and Agricultural Education Lecturers on the technical skills required in:

HO_1: soil selection, climatic requirements and land preparation of *Moringa oleifera*.

HO_2: planting and post planting of *Moringa oleifera*.

HO_3: harvesting of *Moringa oleifera* leaves.

HO_4: processing of *Moringa oleifera* leaves into powder.

Methodology

Design and Area of the Study

The study adopted a survey research design. The study was conducted in Enugu State. Enugu state comprised of seventeen Local Government Areas (LGAs). Enugu State has suitable environmental conditions for the growth of *Moringa oleifera*.

Population for the Study

The population for the study was 40 which made up of 30 Crop Science Lecturers and 10 Agricultural Education Lecturers both from the University of Nigeria, Nsukka. The entire population was studied since it was manageable. The choice of Lecturers was that they were believed to possess enough skills

in Moringa production and processing and therefore in a good position to respond to the instrument.

Instrument for Data Collection

A structured questionnaire consisting of 76 items was used to elicit responses from the respondents. The instrument was face validated by three experts, two from Crop Science Department and one from Agricultural Education Department, all from Ebonyi State University. Cronbach alpha statistical tool was used to determine the internal consistency of the instrument and yielded a co-efficient of 0.79.

Data Collection and Analysis Techniques

The questionnaire was administered by the researchers and the whole instruments administered were retrieved and analyzed. Mean was used to answer the research questions. Nominal values were assigned to different scaling items of the questionnaire and the corresponding Mean Scores were interpreted using real limit of numbers. Any item that had a Mean Score of 3.50 and above was regarded as Highly Required, 2.50 to 3.49 as Moderately Required, 1.50 to 2.49 as Slightly Required and 0.50 to 1.49 as Not Required. Similarly, z-test statistic was used for testing the null hypotheses at probability of 0.05 level of significance. The null hypothesis was upheld for any item whose z-calculated was less than z-table of 1.96 at 0.05 level of significance, and otherwise the item was rejected.

Result

1. Soil Selection, Climatic Requirements and Land Preparation of *Moringa oleifera*.

Table 1: Mean Score and z-test Analysis of the Respondents on Technical Skills Required in Soil Selection, Climatic Requirements and Land Preparation of *Moringa oleifera*

S/N	Items	$\overline{X}_G$	Dec	Crop Science Lecturers $\overline{X}_1$	SD_1	Agric Education Lecturers $\overline{X}_2$	SD_2	z-cal	Rem
1	Select a well drained soil	3.02	MR	3.03	1.00	3.00	1.05	0.08	NS
2	Select a sandy loam or loamy soil	3.09	MR	2.97	1.10	3.20	1.03	-0.22	NS
3	Avoid clayey soil	3.29	MR	3.27	0.87	3.30	0.82	-0.10	NS
4	Select fertile soil rich in organic matter	3.39	MR	3.37	0.81	3.40	0.70	-0.38	NS
5	Avoid waterlogged soil	3.42	MR	3.43	0.97	3.40	0.97	0.09	NS
6	Select termite free soil	3.44	MR	3.47	0.82	3.40	0.84	0.23	NS
7	Select soil with a ph range between 5.0-9.0	3.52	HR	3.53	0.68	3.50	0.71	0.12	NS
8	Grows well in annual rainfall range of 250-1500mm	3.42	MR	3.53	0.78	3.30	1.06	0.63	NS

9	Requires a temperature range of about 25-35^{o}c	3.45	MR	3.50	0.82	3.40	0.70	0.37	NS
10	Clear the land of all vegetation	3.40	MR	3.60	0.67	3.20	1.03	1.15	NS
11	Plough the land by using plough	3.52	HR	3.53	0.82	3.50	0.53	0.14	NS
12	Harrow the land by using harrow	3.54	HR	3.57	0.77	3.50	0.71	0.26	NS
13	Make ridges or beds of 30cm high to facilitate drainage	3.49	MR	3.57	0.68	3.40	1.08	0.47	NS

Note: $\overline{X}$ G = Grand Mean; $\overline{X}_1$ = Mean 1; $\overline{X}$ 2 = Mean 2; SD_1 = Standard deviation 1; SD_2 = Standard Deviation 2; HR = Highly Required; MR = Moderately Required, NS = Not significant; z-cal = z-calculated; NI = Number of Crop Science Lecturers; N2 = Number Agricultural Education Lecturers, z-table = 1.96, N1 = 30, N2 = 10

The data presented in Table 1 above showed that items 7, 11 and 12 had their grand Means 3.50 and above. This implies that the items are highly required(HR) in soil selection, climatic requirements and land preparation of *Moringa oleifera*. The table also indicated that items 1, 2, 3, 4, 5, 6, 8, 9, 10,and 13 had their grand Means ranging from 3.02-3.49 and therefore moderately required(MR) in soil selection, climatic requirements and land preparation of *Moringa oleifera*. Similarly, the table revealed that all the items had their calculated z-values ranging from -0.10 to 1.15 which are less than the z-table value of 1.96 at 0.05 level of significance. This implies that there is no significant difference in the Mean responses of Crop Science Lecturers and Agricultural Education Lecturers on the technical skills required in soil selection, climatic requirements and land preparation of *Moringa oleifera.* Therefore, the null hypothesis(HO_1) of no significant difference was upheld.

2. Planting and Post Planting of *Moringa oleifera.*

Table 2: Mean Score and z-test Analysis of Crop Science Lecturers and Agricultural Education Lecturers on the Technical Skills Required in Planting and Post Planting of *Moringa oleifera*.

S/N	Items	$_G\overline{X}$	Dec	Crop Science Lecturers $\overline{X}_1$	Crop Science Lecturers SD_1	Agric Education Lecturers $\overline{X}_2$	Agric Education Lecturers SD_2	z-cal	Rem
1	Propagate by seeds, seedlings or stem cutting	3.32	MR	3.43	0.94	3.20	1.03	0.62	NS
2	Get seeds from reliable sources	3.40	MR	3.50	0.82	3.30	0.95	0.60	NS
3	Get good seeds that are viable, clean and disease free	3.54	HR	3.57	0.73	3.50	0.71	0.27	NS
4	Sow seeds at a maximum depth of 2cm	3.50	HR	3.60	0.72	3.40	0.97	0.60	NS

5	Plant 1 or 2 seeds per hole	3.64	HR	3.67	0.55	3.60	0.52	0.36	NS
6	Thin or supply when the plant is 30cm high	3.50	HR	3.60	0.67	3.40	0.84	0.68	NS
7	Pre-fill polyethylene bags or sack with damp loamy soil for nursery preparation	3.54	HR	3.67	0.55	3.40	1.07	0.77	NS
8	Sow at a depth of 2cm and 1 to 2 seeds per bag	3.55	HR	3.60	0.62	3.50	0.85	0.34	NS
9	Place the bags in a slightly shaded area	3.62	HR	3.63	0.61	3.60	0.70	0.12	NS
10	Make a small incision on the poly bags to serve as drains	3.58	HR	3.60	0.67	3.56	1.01	0.12	NS
11	Water the seedlings every 2 to 3 days depending on the dampness of the soil	3.54	HR	3.57	0.82	3.50	0.53	0.31	NS
12	Apply 10-12ml of water to each bag	3.57	HR	3.63	0.72	3.50	1.08	0.36	NS
13	Protect the young plant from grasshopper, locust, termite and ruminant	3.45	MR	3.50	0.78	3.40	0.97	0.39	NS
14	Transplant at the height of 30-40 cm	3.62	HR	3.53	0.63	3.70	0.95	-0.53	NS
15	Gently remove the polybag when transplanting	3.64	HR	3.57	0.57	3.70	0.67	-0.55	NS
16	Avoid damaging the roots of the plant	3.47	MR	3.53	0.57	3.40	0.97	0.40	NS
17	Use hard wood of 45-150cm long and 4-6cm diameter for stem cutting	3.55	HR	3.60	0.56	3.50	0.71	0.41	NS
18	Keep the prepared cuttings in shade for 3 days	3.62	HR	3.53	0.82	3.70	0.48	-0.80	NS
19	Plant one third of the length in the soil	3.59	HR	3.57	0.77	3.60	0.70	-0.11	NS
20	Transplant 2-3 months if prepared/planted in nursery	3.55	HR	3.60	0.77	3.50	1.08	0.27	NS
21	Irrigate newly transplanted seedlings	3.50	HR	3.60	0.81	3.40	1.26	0.47	NS
22	Irrigate regularly for the first 2 months in dry and arid climate	3.52	HR	3.53	0.78	3.50	0.97	0.09	NS
23	Apply farmyard or compost manure during land preparation	3.50	HR	3.60	0.72	3.40	0.70	0.78	NS
24	Remove weeds regularly by using hoe	3.64	HR	3.67	0.61	3.60	0.97	0.21	NS
25	Avoid cattle, sheep, pig and goat by fencing	3.62	HR	3.63	0.61	3.60	0.70	0.12	NS
26	Use neem seed preparation as foliar spray to control insects	3.55	HR	3.60	0.62	3.50	0.97	0.31	NS
27	Avoid pesticide that kill or inhibit the growth of beneficial organisms	3.52	HR	3.63	0.61	3.40	0.97	0.70	NS
28	Choose pesticide that targets the specific pest	3.45	HR	3.50	0.73	3.40	0.84	0.14	NS
29	Delay leaf harvesting when chemical pesticide is used	3.32	MR	3.43	0.77	3.20	1.03	0.65	NS

The data presented in Table 2 above revealed that items 16, 17, 18, 19, 20, 21, 22, 23, 24, 25,27, 28, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39 and 40 had their grand Means 3.50 and above. This shows that all the items are highly required in planting and post planting of *Moringa oleifera*. The table also revealed that

items 14, 15, 26, 29, 41 and 42 had their grand Means between 3.32 and 3.47. This implies that the items are moderately required in planting and post planting of Moringa. The table as well indicated that all the items had their calculated z-values ranging from -0.11 to 0.78 which are less than table z-value of 1.96 at 0.05 level of significance. This also implies that there was no significant difference between the Mean ratings of the respondents on the technical skills required in planting and post planting of *Moringa oleifera* and therefore, the null hypothesis(HO_2) of no significant difference was upheld

3. Harvesting of *Moringa oleifer* Leaves

Table 3: Mean Score and z-test Analysis of the Respondents on the Technical Skills Required in Harvesting of *Moringa olaifera* Leaves

S/N	Items	$\overline{X}_G$	Dec	Crop Science Lecturers $\overline{X}_1$	SD_1	Agric Education Lecturers $\overline{X}_2$	SD_2	z-cal	Rem
1	Harvest leaves manually with shears, sickle or sharp knife	3.35	MR	3.40	0.77	3.30	0.82	0.34	NS
2	Harvest when it reaches a height of 1.5 to 2.0m	3.44	MR	3.47	0.68	3.40	0.70	0.28	NS
3	Make first harvesting between 50-90 days	3.47	MR	3.53	0.78	3.40	1.07	0.35	NS
4	Harvest subsequently at 35-40 days interval	3.55	HR	3.60	0.62	3.50	0.97	0.31	NS
5	Cut the entire shoot 30cm-1m above the above the ground	3.54	HR	3.57	0.73	3.50	1.08	0.19	NS
6	Harvest the leaves early morning or late in the evening	3.50	HR	3.40	0.67	3.60	0.70	-0.25	NS
7	Keep the harvested leaves under shade to avoid wilting	3.37	MR	3.43	0.63	3.30	1.06	0.37	NS
8	Ensure that there is no dew on the leaves before harvest	3.47	MR	3.43	0.73	3.50	0.71	-0.27	NS
9	Maintain high level of hygiene during harvesting	3.45	MR	3.50	0.61	3.40	0.97	0.31	NS
10	Transport freshly harvested leaves as quickly as possible to the processing centre	3.62	HR	3.63	0.67	3.60	0.97	0.09	NS
11	Avoid packing the harvested leaves on heaps as it encourages deterioration	3.55	HR	3.60	0.72	3.50	0.97	0.30	NS

The data presented in Table 3 above indicated that items 46, 46, 48, 52 and 53 had their grand Means 3.50 and above. This signifies that those items are highly required in harvesting of Moringa leaves. The table also showed that items 43, 44, 45, 49, 50 and51 had their Means between 3.35 and 3.47 which implies that the items are moderately required in harvesting of *Moringa oleifera* leaves. Similarly, the table revealed that all the items had their z-calculated values

ranging from -0.25 to 0.37 which are lower than the z-table value of 1.96 at 0.05 level of significance. This as well implies that there was no significant difference in the Mean ratings of the respondents on the technical skills required in harvesting of *Moringa oleifera* leaves and therefore, the null hypothesis (HO_3) of no significant difference was upheld.

4. Processing of *Moringa oleifera* leaves into Powder

Table 4: Mean Scores and z-test Analysis of the Respondents on the Technical Skills Required in Processing of *Moringa oleifera* Leaves into Powder

z-table = 1.96 **N1 = 30** **N2 = 10**

S/N	Items	$G\overline{X}$	Dec	Crop Science Lecturers $\overline{X}_1$	SD_1	Agric Education Lecturers $\overline{X}_2$	SD_2	z-cal	Rem
1	Strip all the leaflets from the leaf petiole	3.29	ME	3.37	0.76	3.20	1.02	0.48	NS
2	Remove damaged or diseased leaves	3.35	MR	3.40	0.72	3.30	0.67	0.40	NS
3	Wash the leaves with clean water	3.42	MR	3.43	0.57	3.40	0.52	0.15	NS
4	Wash again in 1% saline solution for 3-5 minutes	3.44	MR	3.47	0.51	3.40	0.70	0.29	NS
5	Finally wash with clean water to remove the saline	3.40	MR	3.50	0.51	3.30	0.95	0.64	NS
6	Strain water from the leaves in bucket that have been perforated	3.49	MR	3.47	0.78	3.50	0.53	-0.14	NS
7	Spread leaves on tray made with mesh and leave to drain	3.45	MR	3.50	0.73	3.40	0.97	0.30	NS
8	Dry the leaves in a well ventilated room	3.59	HR	3.57	0.57	3.60	0.52	-0.15	NS
9	Use insect, rodent and dust proof room	3.52	HR	3.53	0.68	3.50	0.71	0.12	NS
10	Spread the leaflets thinly on mesh tied racks	3.55	HR	3.60	0.50	3.50	0.97	0.31	NS
11	improve air circulation by using ceiling fan	3.34	MR	3.37	0.81	3.30	0.82	0.23	NS
12	Turn the leaves over at least once with sterile groves	3.44	MR	3.47	0.57	3.40	0.70	0.29	NS
13	Use UV treated or opaque polyethylene when drying in a solar dryer	3.54	HR	3.47	0.63	3.60	0.70	-0.52	NS
14	Filter the air intake to keep out dust	3.37	MR	3.43	0.68	3.30	0.48	0.68	NS
15	Use Organza or Muslim cloth as a filter	3.55	HR	3.60	0.56	3.50	0.97	0.31	NS
16	Dry in the dryer for about 4 hours	3.62	HR	3.53	0.78	3.70	0.48	-0.82	NS

17	Dry at temperature between 35 to 55^{o}c	3.65	HR	3.60	0.62	3.70	0.67	-0.42	NS
18	Use electric or gas hot-air in mechanical drying	3.54	HR	3.57	0.68	3.50	0.97	0.21	NS
19	Keep on drying until moisture content is less 10%	3.62	HR	3.63	0.61	3.60	0.70	0.12	NS
20	Pound dry leaves in a mortar or mill with a kitchen blender	3.55	HR	3.60	0.72	3.50	0.71	0.38	NS
21	Mill in stainless steel harmer mill for a large scale production	3.54	HR	3.57	0.68	3.50	1.08	0.19	NS
22	Sieve the leaf powder with a sieve	3.49	MR	3.57	0.73	3.40	0.52	0.78	NS
23	Dry the leaf powder at 50^{o}c for 30 minutes	3.64	HR	3.67	0.66	3.60	0.97	0.21	NS

The data presented in Table 4 above indicated that items 61, 62, 63, 66, 68, 69, 70, 71, 72, 73, 74 and 76 had their grand Means 3.50 and above, which implies that those items are highly required in processing of Moringa leaves into powder. Similarly, the table showed that items 54, 55, 56, 57, 58, 59, 60, 64, 65, 67 and 75 had their grand Means between 3.29 and 3.49 which also signifies that the items are moderately required in processing of Moringa leaves into powder. The table also revealed that all the items had their calculated z-values less than z-table value of 1.96 at 0.05 level of significance which shows that there was no significant difference in the Mean responses of Crop Science Lecturers and Agricultural Education Lecturers on the technical skills required in processing of Moringa Leaves into powder. Therefore, the null hypothesis (HO_4) of no significant difference was upheld.

Discussion of the Findings

The result indicated that all the items such as selection of well drained soil, selection of sandy loam or loamy soil, avoidance of clay soil, selection of fertile soil, avoidance of waterlogged soil, selection of termite free soil, selection of soil with a ph between 5.0 and 9.0 among others are required in *Moringa oleifera* production. This findings were in consonance with Radovich(2011) who reported that *Moringa oleifera* leaves and pod production requires high average daily temperature of 25-35^{o}c, well distributed annual rainfall, high solar radiation and well drained soil. According to the author, growth slows significantly under temperatures below 20^{o}c, and it is relatively tolerant to drought and poor soil, responds well to irrigation and fertilization.

From the study, it was found in Table 2 that all the technical skills were required in planting and post planting of *Moringa oleifera*. These include: propagation by seeds, seedlings or stem cutting, obtain seeds from reliable sources, viable, clean and disease free seeds, among others. This was supported by Palada and Chang (2003) who reported that Moringa is planted either by direct seeding, transplanting or using hard stem cutting, sow one to two seeds per hole at a depth of 2cm for direct seeding. Two weeks after

germination, thin to the strongest seedling per stand. The author stated that pots or bags may be used to grow Moringa in nursery. Other technical skills identified include: irrigating newly transplanted seedlings, irrigating regularly for the first two months in dry and arid areas, applying farmyard or compost manure during land preparation, removing weeds regularly, avoiding cattle, sheep, goat and pigs by fencing, using neem seed preparation to as foliar spray to control insect, among others. This was in line with Sauveur and Broin(2010) who stated that weeding must be regularly done to avoid competition for nutrients, especially for nitrogen. Manual weeding with a hoe removes weeds and loosens the soil for good aeration. According to the author, it is advisable to irrigate regularly during the first three months after seeding for optimal growth. Irrigation is also necessary to produce leaves all the year round including dry seasons. Moringa can produce large quantities of leaves, but only if it receives enough organic supplements. Its leaves are rich in proteins and minerals which means that the soil needs to provide enough nitrogen and minerals to the plant. Instead of chemical fertilizer, farmyard manure or compost can provide the necessary nutrients as well as improve the soil structure (Sauveur and Broin(2010).

The findings of the study showed that harvesting leaves manually with shears, sickle or sharp knife, harvesting when it reaches a height of 1.5-2.0m, making first harvest between 60-90 days, harvesting subsequently at 35-40 days interval, cutting the entire shoot 35-40cm above the ground, harvesting leaves early in the morning or late in the evening, keeping the harvested leaves under shade, ensuring that there is no dew on the leaves before harvesting, maintaining high level of hygiene during harvesting, among others are required in harvesting or Moringa leaves. This was in agreement with Newton (2006) who noted that leaves from high density Moringa fields can be harvested after plants grow 1.5-2.0m, which usually takes at least 60-90 days in a well drained fertile soil. Harvest leaves by cutting the leaf stems manually with a sharp knife at 20-45cm above the ground. The author stated that harvesting in this manner will promote the development of new shoots. Subsequent harvesting can be done every 35-40 days. According to the author, Moringa plants should be harvested at a height where they are high enough so that they are not shaded by the companion crops if any.

From the study it was found that all the identified technical skills in the processing of Moringa leaf into powder are required. This was supported by Doerr and Cameron(2005) who stated that Moringa leaves should be dried in an area protected from light to prevent loss of vitamins and protected from dust. The drying process should be completed as quickly as possible to prevent the growth of moulds. If leaves mould or mildew they should be thrown away or used as compost. The author noted that if humidity of the air is high, leaves should be spread out in a thin layer and mixed frequently.

According to the authors, dehydrators, ovens, driers or fans may be used in cases of extreme humidity.

Conclusion

Moringa oleifera is extremely hardy plant known in Africa, Asia and Latin America. It grows in marginal soil, re-grow after being cut down and one of the few trees that produce fruits during the period of drought. All parts of the plant are beneficial to man including the root, leaves, bark, parts of the fruit and seeds. It is easy to cultivate and process the leaves into powder. Moringa leaf powder is rich in proteins, vitamins and minerals. It can be used to supplement the nutritional needs of the rural families. The anti-fungal and anti-bacterial properties of the plant make it useful to the rural families in taking care of their health problems.

Recommendations

Based on the findings of the study, it was therefore recommended that:

1. The rural families should apply the technical skills identified in Moringa production
   for the cultivation of the plant for their benefit.
2. Skill acquisition centres should integrate the identified technical skills into their curriculum for the training and retraining of youths.
3. National Commission for Colleges of Education (NCCE) should integrate the technical skills identified into the curriculum of Colleges of Education for the training of NCE students who after graduation employed to teach in lower and upper basic schools and therefore impart the knowledge to the students.

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