International Scholars Journals

International Journal of Plant Breeding and Genetics ISSN 2756-3847 Vol. 12 (1), pp. 001-00, January, 2025. Available online at www.internationalscholarsjournals.org © International Scholars Journals

Full Length Research Paper

Traditional Knowledge of Indigenous Pumpkin Varieties (Cucurbita maxima/moschata) in Zimbabwe

Oswell Farai Ndoro[2], Rufaro M. Madakadze[1]*, Susan Kageler[2] and Arnold B. Mashingaidze[2]

[1]Department of Agriculture, University of Zululand, P Bag X1001, KwaDlangezwa, Empangeni, 3886, South Africa.
[2]Department of Crop Science, University of Zimbabwe, P O. Box MP 167, Mount Pleasant, Harare, Zimbabwe.

Accepted 1 November, 2024

A survey was conducted in four districts of Manicaland province of Zimbabwe on pumpkin *(Cucurbita maxima* or *Cucurbita moschata)* to document ethnobotanical knowledge of the pumpkin and to identify the local landraces. Informal surveys for key informants, formal surveys and focus group discussions and other participatory rural appraisal approaches were used in the study. Seven distinct landraces of pumpkin were identified by local names as "Nzunzu", "Ditimanga", "Ndodo", "Hokore", "Musatani", "Dasanana", and "Muzwere". Landrace "Nzunzu" was the most popular followed by "Ditimanga" and "Ndodo". The most prevalent landraces by area were "Nzunzu" (65% of respondents), followed by "Ditimanga", "Hokore" and "Musatani". One landrace (Musatani*), was specifically grown by the local people as a leafy vegetable mainly and was available all year round. Landrace "Nzunzu" had large variegated fruit while "Ditimanga" has large creamy yellow to white fruit. Landraces "Nzunzu", "Hokore" and "Ndodo" have variegated leaves perceived to be resistant to powdery mildew while the rest of the landraces had plain leaves. The pumpkin is grown mostly in intercrops mainly with maize, (85 % respondents) and was planted and grown mainly in summer (67%) as the crop is damaged by frost. Pumpkin is mainly fertilized by cattle manure and most respondents (62%) do not apply an N side dress to the crop. Leaf harvest started 2 - 3 weeks after emergence in landraces such as "Nzunzu" and "Ditimanga" while the other landraces can be started at about 4 weeks after emergence. The pumpkin leaves are consumed 3 - 4 times a week during the rainy season. The main problem during production of pumpkin was insect pests and diseases. Farmers use mainly retained seed (71.9%) for planting that is stored in any available container in the home. This study highlighted local indigenous knowledge of pumpkins and established a baseline of the cultural practices carried out by smallholder farmers.

Key words: Pumpkin, traditional vegetables, landraces, indigenous knowledge, Zimbabwe and participatory approaches

INTRODUCTION

Cucurbits are widely grown in Southern Africa (Chigwe and Saka, 1994; Gwanama and Labuschagne, 1995) for their leafy vegetables, fruits, flowers and seeds that are consumed. Leafy vegetables, fruits and flowers are simply boiled and eaten (Attere, 1990; Chigwe and Saka, 1994) . Pumpkins supply calcium, iron, vitamin A, oil (25 - 55%, rich in unsaturated oleic and linoleic acids), protein (25 - 35%) with high amounts of arginine, aspartate and glutamic acid, although it is deficient in lysine and sulphur- containing amino acids (Chigwe and Saka,1994). Seeds of pumpkins can also be roasted as a snack and made into a paste like peanut butter. Pumpkin leaves were found to be the third most important vegetable (of all vegetables consumed) in Mashonaland West Province and were also quite important in Mashonaland East Province of Zimbabwe (Jackson, 1997). Pumpkin is consumed 3.9 times a week during the rainy season in Mashonaland East Province of Zimbabwe (Van der Sluijer et al., 1997).

Surveys carried out by Van der Sluijer et al. (1997) in 5 districts located all over Zimbabwe indicated the most common traditional vegetables as the domesticated Cu-

*Corresponding author. E–mail: rmadakad@pan.uzulu.ac.za or rmadakadze@yahoo.co.uk. Tel: +27 35 902 6062. Fax +27 35 902 6062. Mobile: 27 72 243 3812

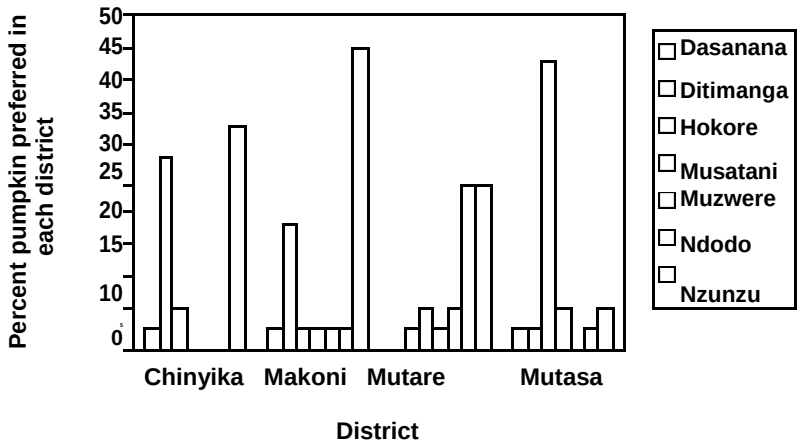

Figure 1. Pumpkin landraces most preferred in each of the surveyed districts (n = 160).

Cucurbita species (*muboora),* B*rassica juncea* (tsunga), and *Vigna anguiculata* (*nyemba*), the semi cultivated *Cleome gyanandra (nyeve),* and the wild *Corchorus* species *(derere)* and A*maranthus species (mbowa)*. These surveys also showed that Manicaland and Mashonaland East were the major vegetable producing areas in Zimbabwe. Manicaland province stretches along the eastern border of Zimbabwe and covers all the 5 Natural Farming Regions (NFRs) of the country. Each of the 5 NFR has different conditions in terms of temperature and rainfall hence different major farming activities.

No work to date has looked at the landraces of pumpkins that are grown by smallholder farmers and collected the knowledge that is available in the farmers on these vegetables. Initial identification and characterization of collected material or accessions provide breeders with considerable amount of information concerning their value to particular breeding programs. Breeders may then exploit these genetic resources in several ways to produce new cultivars. The goals of this study were to identify the different landraces of *Cucurbita maxima-moschata* that are grown in Zimbabwe, to document ethno botanic knowledge on characterisation of pumpkin landraces and to identify production constraints as well as the potential for improvement of these vegetables in the small holder-farming sector of Zimbabwe.

MATERIALS AND METHODS

A diagnostic survey and a formal survey were both conducted in Manicaland Province of Zimbabwe. Participatory Rural Appraisal techniques incorporated in the survey included key informant interviews, focus group discussions, group pair wise ranking and checklists (Friss-Hansen and Bhuwon, 2000) . Three districts of Mutare, Makoni and Mutasa were selected due to their representativeness in terms of equitable distribution of the four natural ecological regions (NR1 to IV)

Key informant interviews engaged at least four people per district to obtain specific information on practices, problems, constrains and opportunities on pumpkin production and utilization. some years, had owledge about other farmers, had some

The key informants were farmers, who had lived in the area for education, and were decision makers in their households. Information from key informant interviews was then synthesized and consolidated with information from document reviews to formulate the questionnaire for the formal survey. A total of, 14 key informants from all the districts involved were interviewed. Checklists were used to facilitate discussions with key informants who were selected with the assistance of local extension officers of the Department of Agricultural Research and Extension Services (AREX).

A questionnaire that investigated the types and preferred landraces, production practices; processing methods and utilization of pumpkin was developed. The questionnaire was coded, translated and pre-tested in Chinyika Resettlement Scheme. One hundred and eighty six people were interviewed and information from 160 questionnaires was analysed using the SPSS statistical package (SPSS, 1989). Focus group discussions were carried out in each district (at least one in each district) to consolidate information from individual interviews and key informants. Eight to ten people, mostly women made up the focus group discussions. The members of the focus group discussions were chosen randomly in the specific villages used and these were not used in the individual household questionnaire. The rankings and ounts/frequencies of each landrace from pair-wise ranking was expressed as a percentage and used for the overall ranking. Pair -wise ranking was carried out in focus group discussions. For each pair of landraces the group used consensus oriented discussions to determine which one was preferred and a pair- wise matrix was constructed.

RESULTS

Seven distinct landraces of pumpkins were identified in the survey areas. The descriptions for each of the identified landraces, are shown in Table 1. The leaves of landraces “Nzunzu”, “Hokore” and “Ndodo’ are variegated whereas those of “Dasanana’, “Ditimanga”, “Musatani’ and “Muzwere” are not. The landraces “Hokore” and “Ndodo” have thick spines that can cause itching on skin. Landrace “Ndodo’ was reported to have the sweetest fruit. Landraces “Ditimanga” and “Muzwere” produces

Table 1. Common pumpkin landraces and the descriptors generated from the survey (n=160).

Landrace common name	Leaves	Stems	Fruits	Frost and disease tolerance
Nzunzu	-Deeply variegated -Large deep green with long petiole - Soft and dense spines	-Deeply angled and long -Strong branching tendency.	-Large variegated, green and yellow. -Round to oval shape. – Yellow or cream flesh colour -Thin edible rind	Moderate tolerance to frost. -Tolerates nematodes
Ditimanga	-Large plain, light green leaves with large hollow? petiole. -Short sparsely distributed spines	Very thick round, fleshy and long stem	-Very large, round, flat yellow to orange fruit with depression at blossom end with pale yellow flesh. Flesh is firm and sweet Thin and edible rind	-Highly susceptible to frost, and powdery mildew.
Hokore	-Slight variegated small, rough, leaves with thick, tough and prickly spines.	-Stems are short, deeply angled and woody.	Small, grey to yellow colour pear shaped fruit. Yellow to orange flesh. Thick and non edible rind.	-Severely affected by frost.
Musatani	-Plain, soft, small leaves with small soft and white spines	Thin, short but good climber.	Numerous, small, round not normally eaten Pale yellow flesh that becomes watery when cooked.	- High degree of frost tolerance.
Dasanana	-Large plain light green leaves with thick long, large and hollow petiole. Short, sparsely distributed spines.	-Very thick round and very long but poor branching habit.	Very large, flat to round sometimes ribbed. -Grey to yellow colour dominant. White to cream or yellowish flesh. Edible rind.	-Highly susceptible to frost, aphids and powdery mildew
Ndodo	-Slightly variegated dark green, small rough leaves with thick, dense spines.	- Short deeply angled and woody.	Grey to yellow. -Coarse grained and firm, very sweet flesh. Thick and inedible rind	Severely affected by frost, and powdery mildew
Muzwere	-Large, with thick and long petioles Thick and sparsely distributed spines	Very thick, round, long and fleshy.	-Very large, flat to round fruit, white to yellowish grey in colour. The flesh is yellow to orange. Thin and edible rind.	Very susceptible to frost and powdery mildew

Landraces “Ditimanga” and “Dasanana’ with plain leave-sare reported highly susceptible to frost and powdery mildews (Table 1). Table 2 shows the prevalence and general preference ranking of pumpkin landraces by respondents. “Nzunzu” was the most preferred landrace followed by “Ditimanga” with “Musatani” as the least popular landrace as it produced small fruits that did not taste good. Preference in “Mutasa” was heavily biased towards “Hokore” a landrace that was considered to have a very pleasant fruit while Chinyika, Makoni and Mutare were heavily biased toward the multi-purpose Nzunzu (Figure 1).

Retained seed constituted the bulk of the seed source (71.9%), some farmers borrowed from neighbours Regis-tered seed agents or seed companies especially for (11.3 %) and the rest (16.9%) bought seed from “Ditimanga” (that looks like Flat White Boer) (Table 3). Containers for seed storage could be any that was easily available and could serve the purpose. Pumpkin seeds are mostly stored in bottles (36.3%) with currently very little stored in gourds (7.5%) and clay pots (9.4%) (Table 3). Most of the farmers (72.5%) do not use any specific seed protect-tion mechanism in storage. Only a few farmers use smoke in kitchens (4.4%), plant leaves (5.0%) and crop protection chemicals (8.8 %).

Most of the farmers selected landraces to grow based on size of the fruit (38.6%), fast growth (28.8%) and good taste/ quality (19.7%) (Table 3). The planting dates for most of the pumpkin landraces was established as early summer (October to December) followed by late summer

Table 2. Prevalence and general preference ranking of pumpkin landraces by area and % of respondents.

Landrace	Prevalence % By area	Prevalence % Of Respondents	General Preference Ranking
Nzunzu	65	26.2	1st
Ditimanga	60	16.0	2nd
Ndodo	40	14.0	3rd
Hokore	60	12.8	6th
Dasanana	40	5.5	4th
Muzwere	40	4.9	5th
Musatani	60	4.0	7th

Table 3. Landrace selection criteria, seed sources, storage and protection used for pumpkin grown expressed as a percentage of the total respondents (n=160).

Practice	Levels or practices	Percent respondents
Selection Criteria	No selection	2.5
	Size of fruit or leaves	38.6
	Fast growth	28.8
	Good taste/quality	19.7
	Frost tolerance	11.2
Seed Source	Retained seed	71.9
	Neighbours	11.3
	Shops/seed companies	16.9
Storage containers	Bottles	36.3
	Polythene/Plastics	16.9
	Gourds	7.5
	Clay pots	9.4
	Others eg lunch boxes	30.0
Seed protection mechanisms	No protection	72.5
	Smoke in kitchens	4.4
	Mix with sand and ash	9.4
	Use of plant leaves	5.0
	Use of chemicals	8.8

(February to April) and winter (June to August) with very little planted all year round (Table 4). Winter plantings of pumpkin were done in vegetable gardens and *dambos* (vlei areas) together with exotic vegetable in frost free areas.

Most of the pumpkin was intercropped (85%) while only 10 % was planted as sole crops (Table 4). The pumpkin seed is either planted in rows of main crops or broadcast depending on what implements the farmer has for cultivation. The landraces that could be planted as sole crops according to the respondents were “Nzunzu” (3.8%), “Ditimanga” and “Hokore” (1.9 %) and “Musatani” (1.3%). The plant spacing of pumpkin was largely varied with few farmers (7.5%) observing plant spacing of less than 2 m by 2 m, some preferred more than 2 by 2 m (18.1%) while the rest 74.4% broadcasted their pumpkin and did not worry about the spacing (Table 4). Kraal manure was the most frequently used basal dressing (38.1%) while equal amounts (28.8%) of the respondents used either compound fertilizers or did not use any fertiliser (Table 4). A few of the farmers used anthill soil as a basal dressing. A lot of the farmers (61.1%) did not use any top dressing fertiliser while only 5% used manure as a top dressing fertiliser. “Ditimanga” and “Nzunzu” landraces were considered to be very good in terms of earliness of harvest (Table 5***)***. Their leaves were available 2 to 3 WAE while the other landraces could be harvested from 4 weeks onwards. Harvesting practices ranged from pinching off one leaf to pinching off five leaves per plant per reaping with a mean of 2.38. The most common number of leaves harvested was 2 leaves per plant (50.6%) followed by 3 leaves (21.9%) (Table 6). Consumption frequency of pumpkin leaves when in season ranged from 2 to 7 times a week with a mean of 3.94. Most respondents preferred to consume pumpkin leaves every other day (Table 6) during the season, and

Table 4. General planting times, planting methods and spacing and fertiliser practices carried out by farmers expressed as a percentage of the total respondents across landraces and districts (n=160).

Cultural Practice		Percentage of respondents
Planting time	Early Summer	67.5
	Late Summer	11.9
	Winter	7.5
	All year round	2.5
Planting method	Mono- cropping	10
	Intercropping	85
	Others	5
Plant Spacing used	Less than 2 x 2 m	7.5
	2 x 2 m plus	18.1
	Broadcast (no spacing)	74.4
Basal Fertiliser	Nothing	28.8
	Compound Fertiliser	28.8
	Manure	38.1
	Anthill soil	4.4
Top dressing	Nothing	61.9
	Ammonium nitrate	33.1
	Manure	5.0

Table 5. Earliness of pumpkin as shown by the estimated number of weeks after emergence (WAE) to first leaf harvest cross tabulated with landrace (n = 160).

	Estimated number of weeks after emergence (WAE) to first leaf harvest							
Landrace	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Unknown	0	0	0.6	0	0	1.9	0	0
Dasanana	0	1.3	0.6	1.3	1.9	0	0	50.
Ditimanga	0.6	8.1	3.1	5.6	0.6	1.3	0.6	0.6
Hokore	1.3	0.6	1.3	9.4	1.3	1.3	0	0
Musatani	0	0.6	1.3	3.1	1.9	0.6	0.6	0.6
Muzwere	0	0	0	0	0	2.5	1.3	0
Ndodo	0	1.3	0.6	3.1	0.6	1.9	1.3	2.5
Nzunzu	0	9.4	2.5	7.5	6.3	2.5	1.9	1.3
Nyamutumha	0	1.3	0	0.6	0	0	0	0
Total %	1.9	22.5	10.0	30.6	12.5	11.9	5.6	5.00

Table 6. Number of pumpkin leaves harvested per reaping and consumption frequency per week across landraces and districts (n=160).

Cultural Practice	Levels	Percent respondents
Actual number of leaves harvested per reaping	1	15.0
	2	50.6
	3	21.9
	4	6.9
	5	5.6
Times per week when leaves are consumed in rainy season	1	8.8
	2	18.1
	3	25.0
	4	16.9
	5	4.4
	6	3.8
	7	23.1

Table 7. Problems associated with the production, harvesting, processing, and marketing of pumpkin landraces (n = 160).

Stage of the pumpkin crop	Problem	Percent respondents
Production	No problem	22.4
	Pests and diseases	60.7
	Drought	6.4
	Lack of inputs	13.1
Harvesting	No problem	70.8
	Pests and diseases	24.0
	Labour constraints	2.5
Processing	No problem	51.4
	Inadequate sunshine	40.9
	Moulding/rots	8.1
Storage	No problem	60.2
	Pests and diseases	29.3
	Loss of quality	10.6
Marketing	No problem	39.6
	Glut	52.5
	Transport shortage	4.9

alternate with other traditional vegetables such as Mustard rape (*B. juncea*), *C. gyanandra, Cleome monophyla* and *Corchorus tridens* which were used as relish during the other days. The problems identified for each of the stages of pumpkin production are listed in Table 7 below with the percentages of respondents who identified the problems across all districts and landraces. The biggest problem reported was insects and diseases (60.7%) in the production stage followed by gluts (52.5%) in the marketing stage and lack of adequate sunshine (40.9%) in the processing stage.

DISCUSSION

In most of Southern Africa, pumpkin production is from seed from landraces that have been maintained by farmers over long periods of time (Gwanama et al., 2000, Chigwe and Saka, 1994). In this study seven distinct landraces with local names were found in Manicaland province of Zimbabwe. The names could be different in other provinces based on dialect. The distinctions between different landraces emanated from the inherent characteristics of the landraces. Some names were coined from the leaf and fruit colour eg. ("Nzunzu"*),* some from their fruit size ("Ditimanga"), while others were coined from taste of the fruit ("Ndodo"), and from rind thickness ("Hokore") respectively. "Nzunzu' and "Ditimanga" were the most popular landraces according to the rankings by farmers. Preference rankings were based mostly on the taste of both the fruit and the leaves after cooking, tolerance to pests ("Nzunzu") and fruit size ("Ditimanga"). The popularity of "Nzunzu" was also closely associated with its resistance to powdery mildew and possibly fruit fly. "Musatani" was the only landrace that had a high degree of frost tolerance and in some cases was available throughout the year.

The Plant Genetic Resource Centre in Zimbabwe does not currently have these pumpkin landraces in stock (Mujaji, Director National Gene Bank, Zimbabwe, personal communication). Different countries in the SADC region have different numbers of accessions of *Curcubita* sp with Botswana having 8, Tanzania 28 and Zambia 252 (Nkoma et al., 2005). Collection of indigenous knowledge and conservation of these identified landraces is very important for pumpkin breeding and improvement in Zimbabwe. Further characterization and evaluation of the identified landraces is needed in order to confirm the information supplied by the farmers. Morphological and molecular characterization of germplasm is needed in order to make the collection useful.

Most of the farmers use retained seed indicating owner-hip of the landraces. There is currently only one cultivar (Flat White Boer) that is sold by seed companies in Zimbabwe. This cultivar is highly susceptible to fruit fly and zero fruit yields can be obtained under severe infestations. An evaluation of appropriate storage containers and community seed banks could go a long way in conserving the landraces that are kept by the farmers.

Most of the farmers (85% of respondents) grow the pumpkins in intercrops with maize and other crops. The main reason for the production of this crop in intercrops could be because of lack of land and labour in most rural areas in Zimbabwe. Wiley (1979) reported that growing crops together makes more efficient use of land, labour and fertilizer than growing them separately. The fact that these crops could be grown as intercrops suggests fast growth and an ability to withstand some degree of shading. Preliminary studies on maize/pumpkin intercropping in Zimbabwe have shown that pumpkin intercropping reduced weeding frequency from three to one when compared to sole maize also suggesting fast growth of the pumpkin that hinders weed growth (Mashingaidze et al., 2000).

Pumpkin cultivars are fairly long season requiring 4 - 6 months frost free time for production. In this study the farmers reported that landraces “Nzunzu” and “Ditimanga” require early planting possibly indicating that they are long season. Landraces “Dasana”, “Ndodo” and “Hokore” can be planted in late summer suggesting that they could be shorter season crops compared to ‘Nzunzu’ and “Ditimanga”. This shows the existence of germplasm that could be subsequently developed into short and long season varieties. These results are however not conclusive as farmers in all districts mentioned also that landraces “Nzunzu” and “Ditimanga” were good in terms of earliness of harvest. Farmers also mentioned that there is immature pumpkin fruit (jekera), at the end of the rainy season that were harvested and included with the leaves and flowers as vegetables to accompany the main meal. The late planted landraces could simply have sweeter fruit that can be utilized in the immature state.

There are also indications from the information provided by the farmers that the landraces “Nzunzu” and “Ditimanga” have fast growth and the ability to rapidly regenerate as leaves can be harvested from 2 to 3 weeks after emergence and the plants can withstand heavy defoliations of 3 - 4 leaves per reaping. This attribute is desirable and could be selected for in most varieties that are grown for their leaves.

There were no intentional fertilizer programmes for pumpkin in all districts except in isolated cases where mostly “Nzunzu” was grown as a mono-crop and top-dressed with ammonium nitrate indicating lack of resources of farmers for this crop. Chemical spraying for pest control was limited with 69.9% of the respondents not spraying their crops.

Low frequency of spraying exerted a high selection pressure on the landraces for pest tolerance or resistance. Landraces that succumbed to pumpkin fly were not very popular with farmers as there can be no fruit harvest. “Ditimanga” a landrace described as similar to the commercial variety White Flat Boer was rated very lowly in terms of tolerance to pests especially the pumpkin fruit fly.

Two to 3 leaves of pumpkins are harvested per reaping and the pumpkins were consumed 3 to 4 times per week during the rainy season. This concurs with the consumption patterns reported in Uzumba Maramba Pfungwe district in Mashonaland East province of Zimbabwe (Van der Sluijer et al., 1997).

A number of farmers dried their pumpkin leaves for later use. “Ndodo” and “Ditimanga” were noted as the only landraces that produced good dried leaves that could be rolled well during drying. Many farmers stored undamaged whole pumpkin fruit with the peduncle attached under the shed of the granary for periods ranging from 2 to 6 months. Removal of the peduncle greatly reduced the storage period of the pumpkin fruit.

Insect pests and diseases were reported to be the biggest problem (60.7% respondents) in the production of the pumpkins and gluts on the market (52.5% of respondents) in the marketing and processing phases. Although some of these landraces (Nzunzu and Ndodo) are thought to be disease and insect pest tolerant this needs to be confirmed and an active selection and breeding programme be started to increase resistance to diseases.

Conclusion and Recommendations

In conclusion, seven distinct pumpkin landraces were identified locally as “Nzunzu”, “Hokore”, “Musatani”, “Diti-man-a”, “Dasanana”, “Ndodo” and “Muzwere”. The most popular pumpkin landraces were the variegated “Nzunzu” and the large fruited “Ditimanga” in 3 of the surveyed areas while ‘Hokore” was the most popular landrace in Mutasa because of its sweet fruit. One landrace (Musatani) was grown mainly for its leaves and was available all year round. Most of the pumpkin landraces were grown in summer. The major criteria for seed selection or varietal preference were taste, size of both fruit and leaves and disease tolerance. The crop is mainly grown in intercrops in summer in Zimbabwe. This study could form a good basis of a systematic research programme on dryland maize/pumpkin production, with the work being done with known pumpkin cultivars. Similar studies must be done in other areas so that the collected germ-plasm can be characterised and the cultivars named and availed on a national basis, given the importance of the pumpkin in maize-based cropping systems of Zimbabwe.

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