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Original Article

An Assessment of Maize Production Status, Challenges and Opportunities in the Zambezi Region of Namibia During the Period 2011 to 2020

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Abstract: *This project presents a study on the constraints and opportunities of maize production in the Zambezi Region of Namibia. The study aimed to provide information that would set the basis for assessing and improving maize production methods used by communal farmers in the Region and eventually the impact of the project on the livelihoods of the target population. Its objective was to flag the potential of optimum production on a small piece of land using minimal agricultural inputs. A demonstration plot was established. Twenty-eight basins 60cm apart were dug in rows 52 rows 16 meters long. This setup was done within an area of 39 by 16 meters, that is, 624m2. About 20g of basal organic fertilizer (cow dung) was placed with two maize seeds in each basin before covering them with a 2 to 5 cm layer of the dug-out soil. Drip irrigation was procured to water plants and mitigate the excessive heat. Weeding was done as necessary with top dressing fertilizer type 5:3:4 (N: P: K) applied five weeks post-germination and at the tasselling stage. Green maize was harvested three months after planting, whilst the rest of the maize left to get to the dry form was harvested a month later. The results revealed that one per cent (1%) of the maize cobs were diseased. Two thousand four hundred maize cobs were harvested, with a mean length of 17.9cm and 14 seed rows per cob. Averages of 136 seeds per cob, two grams per seed, and 272 grams cob weight were recorded. The extrapolated result of the demonstration plot was yielded 11 tons of maize per hectare.*

Keywords: *Production status, Assessment of maize, challenges and opportunities, Zambezi Region.*

I. INTRODUCTION

A) Background

Zambezi Region of Namibia, with a surface area of 14,785 km^2, is part of the Kavango Zambezi Trans-Frontier Conservation Area (KAZA TFCA) which is inhabited by about 95,000 people where 38% of the population is found in 9,193 agricultural households (NSA, 2016; MAWF, 2015; Harring & Odendaal, 2012). The world has only one international quadripoint consisting of Botswana, Namibia, Zambia and Zimbabwe and Zambezi Region of Namibia borders these four countries and its northwestern side, which borders Angola (Landmarks & Icons, 2016). Two perennial rivers, Zambezi and Kwando, sandwich this wetland paradise endowed with rich biodiversity (WWF, 2019).

In general, the majority of people in the communal areas of Zambezi Region derive a livelihood from subsistence agro-pastoralism, fishing, tourism, government reliefs, social grants and harvesting of natural wildlife resources like timber and devil's claw (*Harpagophytum procumbens*) (Kamwi, Chirwa, Manda, Graz & Kätsch, 2015). About 160,000 cattle, a few thousand small stock and donkeys cohabitate the Zambezi Region with an endowment of 450 wild animal species and 339 bird species wandering the pristine seringa, copal wood and Zambezi teak forest sanctuaries.

Anthropogenic factors that have caused global climatic and edaphic changes did not spare the Zambezi Region, where rainfall has become erratic. However, the trends are better than those of other regions of Namibia. Mendelsohn and Roberts (2002) described soil conditions in the Region as favourable, thus, encouraging cropping and rangeland for livestock rearing. Despite its great agricultural potential, a well-organized traditional village fabric and traditional authority governance, Zambezi Region is one of Namibia's most impoverished regions (Harring & Odendaal, 2012). According to NSA (2016) and Harring and Odendaal (2012), the Region has 48% unemployment, the highest school failure rate, the highest HIV infection rate, a very high per capita alcohol consumption and the lowest life expectancy; 40 years.

In Zambezi Region, community donor-dependant agro-pastoral developmental initiatives like elsewhere in Southern Africa, as supported by Norman (2012), have lacked sustainability and resilience, possibly because of inadequate recipient appreciation of benefits and communalized benefit sharing. Furthermore, the absence of beneficiaries' financial commitment to donor and government-funded initiatives dampens the preservation prudence. The latter is a recipe for poor sustainability.

And as a consequence not only is there poor project sustainability upon cessation of donor support but also attrition during project implementation. A myriad of donor funded projects implemented in Zambezi Region in the past 20 years did not leave any footprint. 'Push,' rather than 'pull' factors dominated the modus operandi of most donor funded projects. Project implementers perhaps driven by deadlines of deliverables push participants or beneficiaries for rapid adoption of concepts in a rural framework or normally change of mind-set is a slow process. Beneficiaries must find concepts suggested being attractive and they must be 'pulled' into projects and to sustainably adopt new or adjusted agricultural practices.

It is prudent to address the negative dynamics of climate and soils by adopting conservation agriculture modalities in order to revitalize quality and quantity of crop production and safeguard food production hence food security of not only Zambezi Region but the rest of Namibia and to diverge from being what Schlettwein described as "an economy that consumes what it does not produce and produces what it does not consume" (Schlettwein, 2020).

A game changer for socio-economic factors in order to sustainably develop livelihoods in Zambezi Region is a deliberate focus on adequate quality agricultural production backed by a sound financial stimulus, market provision, agripreneuririal micro finance, knowledge transfer, minimization of crop and crop product wastage, crop value addition, increase of agriculture products' shelf life and an extended period of donor beneficiary interaction. This should be done through judicious utilization of land, provision of water and adoption of planet-smart conservation agriculture practices.

The government's goals of sustainable eradication of poverty also enunciated in the Millennium Development Goals (NSA, 2019), can be supported by technocrats, donors and the government itself if focus is directed towards a holistic knowledge-based change of communal farmers' mind-sets in crop management, livestock husbandry, rangeland management and livestock marketing.

Ownership of ancestral land by the communities and the current legal land tenure registration by government is positively encouraging inhabitants to develop permanent residential structures; enhancing their propensity or willingness to manage crop-land as a valuable resource for sustainable planet-smart agrarian practices. Farmers should therefore have adequate exposure to new and tested result-evident farming practices. Such an exposure will inculcate an intrinsic urge to emulate and adopt beneficial agricultural practices or interventions and in most cases guarantee sustainability.

B) Problem statement

Communal farmers in Zambezi Region can potentially optimize maize production but material and knowledge gaps keep yields way below the envisaged levels.

C) Aim

The aim of the study is to provide basic information for the assessment and improvement of maize production methods practiced by communal farmers in the Region.

D) Objectives

The main objective of the study is to demonstrate the potential of optimum maize production on a small piece of land in comparison with a yield from another plot with different intervention. Our aim here is to compare the current production in Zambezi Region with the potential production of the Region.

E) Project justification

The SARS-CoV-2 virus causing the current Covid 19 pandemic is not sparing Namibia of an unprecedented health and economic demise while paradoxically tweaking a post-corona transformational imperative for communities and the country at large to promote local food production tallied to and guided by best local practices and ditch the dependency on other countries like South Africa and Zambia. Development of sustainable globalized, agro-ecological initiatives will not only galvanize food sovereignty but will deal with the often peripherated, mitigation of global warming. Schlettwein, (2020) admittedly juxtaposed COVID-19 pandemic to global warming and food self-sufficiency by pronouncing that "the current global economic downturn, the ongoing COVID-19 pandemic, climate change and climate variability has negatively impacted economies around the world, including ours".

II. LITERATURE REVIEW

Namibia has an Exclusive Economic Zone sea surface area of 489 474 km², territorial waters sea surface area of 23 541 km² and a total land area of approximately 824,292 km² of which 687 400 km² (83.5 percent) is considered to be available for agricultural land use (NSA, 2016; MAWF, 2018). The country has an estimated annual GDP per capita of US$5,828.00 equivalent to N$101,028.84 where mining, fishing and tourism contribute most to this value whilst agriculture's contribution of

5.1% trails behind these industries. 30% of the gross agriculture income is derived from crops and 70% from livestock. Only 6% of the latter comes from communal areas' livestock despite the high population of animals in these areas. Although the quality of livestock and crops in communal areas is often poor, 70% of Namibians derive livelihoods from agriculture (Ministry of Industrialisation, 2017)

The northern communal areas (NCAs) of Namibia constitute 35% of the Namibian land and are inhabited by 62% of the Namibian population most of them deriving livelihood from agrarian activities and livestock rearing. The NCA communities own in excess of 1.6 million cattle and 2 million small stock and they farm crops like mahangu, maize, sorghum, wild water melon, pumpkins including a variety of other indigenous vegetables. The crop production yields in NCA are not enough to provide annual household food security let alone make a contribution to the national food sovereignty. Furthermore, the product quality of livestock or crops in most cases is subnormal to attract significant foreign market demands hence income.

White Maize Area Planted, Production: Zambezi Region 2014 to 2016 (NAB, 2017)

White Maize Area Planted, Production: Zambezi Region (once a year).				
Area and Yield	**2014**	**2015**	**2016**	**Average**
Area (ha) planted Rain Fed	12489	13138	9894	11840
Yield (tonnes)	4458	1293	1021	2257
Average yield per ha (tonnes per ha)	0.4	0.1	0.1	0.2
Average yield per ha (kgs per ha)	357	98	103	186
Average yield per ha (50kg bags per ha)	7.0	2.0	2.0	3.7
Financial income / ha (N$5000/T) N$	1784.8	492.1	516.0	930.9
Yield (T) per agriculture households	0.5	0.1	0.1	0.2
Minimum Possible production if best practices are employed (one season work).				
Area and Yield	**2014**	**2015**	**2016**	
Area (ha) planted Rain Fed	12489.00	13138.00	9894.00	11840.33
Yield (tonnes)	124890.00	131380.00	98940.00	118403.33
Yield per ha (tonnes per ha)	10.00	10.00	10.00	10.00
Yield per ha (kgs per ha)	10000.00	10000.00	10000.00	10000.00
Yield per ha (50kg bags per ha)	200.00	200.00	200.00	200.00
Financial shortfall if new practices are not employed (one season work).				
Area and Yield	**2014**	**2015**	**2016**	
Area (ha) planted Rain Fed	12,489.00	13,138.00	9,894.00	11,840.33
Yield (tonnes)	124,890.00	131,380.00	98,940.00	118,403.33
Yield per ha (tonnes per ha)	10.00	10.00	10.00	10.00
Yield per ha (kgs per ha)	10,000.00	10,000.00	10,000.00	10,000.00
Yield deficit per ha (50kg bags per ha)	9.60	9.90	9.90	9.80
Financial losses / ha (N$5000/T) N$	48,215.23	49,507.92	49,484.03	49,069.06

**Zambezi Region has 9193 agriculture households*

The minimum possible production if best practices are employed is 10 tons per hectare per season translating to 30 tons in a total of 3 production cycles per year. A family of six will need one ton of maize for self-consumption in a year (Machingura, 2020). The current production levels in Zambezi Region are disturbingly well below the Region's potential.

Most of the farms in Zambezi Region hardly exceed a hectare in size and the need for more food necessitates decimation of pristine forests in order to get better quantities of produce for food security. Unfortunately, not only is this a macro social threat to the nature conservation efforts but a direct contribution to climate change through the ablation of carbon sequestration processes normally provided by forests. Furthermore, it results in destruction of wild flora and shrinkage of wild animal habitats, a violation of the human wildlife cohabitation norm constitutionalized by the Namibian government.

1. It will be in the farmers' interest to know the maize import statistics for Namibia. This is also supports the choice of crop, maize.
2. A systemic challenge of existential dimensions is Namibia's chronic net importation of staple food Mahangu and maize. Zambezi Region borders Zambia which is a net exporter of maize. Edaphic and hydrogeological parameters are the same in this part of the planet leaving agricultural epistemic limitations for Zambezi Region, which should be addressed. Rao (1997) has explained that "If there is a problem to be solved, seek for statistical advice instead of appointing a committee of experts. Statistics and statistical analysis can throw more light, than the collective wisdom of the articulate few" (Rao, 1997).

The following statistics show Namibia's unhealthy annual dependency on other countries for maize and the obvious imperative for local production.

Table: Maize imports and local production per financial year (NAB 2020)

Financial year	Imports average 51% (tonnes)	Production marketed 49% (tonnes)	Total (Minimal) National consumption
2010/2011	81,111	47,961	129,072
2011/2012	55,305	63,228	118,533
2012/2013	105,742	72,438	178,180
2013/2014	170,234	36,694	206,928
2014/2015	82,527	69,433	151,960
2015/2016	120,650	38,900	159,550
2016/2017	110,229	43,940	154,169
2017/2018	50,483	76,660	127,143
2018/2019	59,608	58,020	117,628
Average	**92,877**	**56,364**	**149,240**

The average maize deficit of Namibia is 92,877 tonnes per year. If purchase, clearance and transportation of maize from foreign countries costs N$5,127.00 (cost of maize per tonne in Namibia), then the total opportunity cost for the country is N$476,178,100.33. This contribution to GDP deficit can be averted by "bringing the farm to the plate not bringing food to the plate".

Furthermore, if some communal farmers can passionately be engaged into judicious agro-production and achieve an average of 10 tons per hectare then 9,288 hectares are needed to produce the 92,877 tonnes deficit of maize per annum. Provision of drip irrigation on 1 ha farms with a production cycle of 4 months will reduce the hectare to 3096 hectares. Zambezi Region has less than half of the 9193 agriculture households cropping on one-hectare land pieces and equipped with crop irrigation material, expertise and sufficient motivation can produce enough maize to thwart the prevailing annual national deficit.

Silos not full

Location	Storage capacity (T)	Maize yield per year (T)		
		2013	2015	2016
Tsandi	3000			
Omuthiya	4000			
Okongo	4500			
Rundu	4000			
Katima Mulilo	**7400**	**4458**	**1293**	**1021**
Total	22900			

3. There are 3 main maize depots - Kamunu, Amta and Agrimill. Agrimill and Kamunu import a minimum of 60 tonnes of maize from RSA every fortnight because of poor local maize availability.

III. MATERIALS AND METHODS

A) Plot A

a. The farmer selected a portion of land that had a virgin section and another that was ploughed the previous year. 28 basins (approximately 60cm apart) were dug in rows 16 meters long. A total of 52 rows were established within 39 meters. Two family members assisted by a casual worker from the village nearby, prepared the basins. The work was done in 3 days. The worker was paid N$75.00 per day. A hoe was used to prepare 15 cm cube basins. About 20 g of basal organic fertilizer was placed with 2 seeds in the basins before covering them with 2 to 5 cm layer of the dug-out soil. The concept of digging hatched the term 'Yepa Ukule Project' (Dig and be satiated) at Tanaka Village. Planting was done on the 22nd of November 2019.

b. There was 51mm of rain during the night of the 22nd November 2019. Germination started days 5 post seeding with further rainfall of 45 mm a few days later. The ambient temperature was however an average of 39^{o}C with the maximum soaring to 43^{o}C. Mulching was not done because of labour cost challenges.

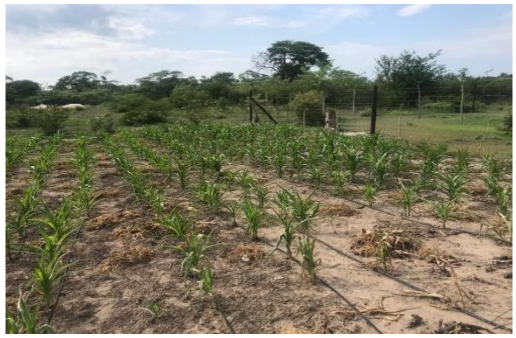


Figure 1: Rainfall and irrigation

c. Drip irrigation was procured and assembled 11 days post-seeding in an endeavor to mitigate the excessive heat. The drip irrigation gadgetry had challenges of poor pressure hence water delivery. The electricity costs also limited optimum use of this method of water provision.

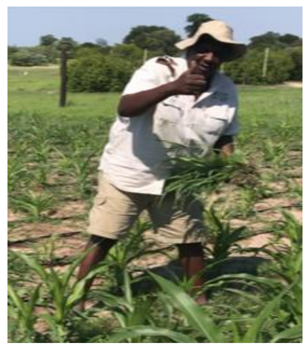


Figure 2: Weeding and thinning

d. Weeding was done by family members assisted by a casual worker from a nearby village. The worker was paid 75.00 per day for 3 days by the farmer.

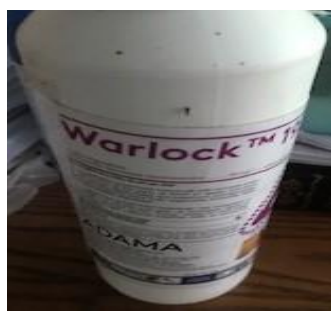


Figure 3: Pests control

e. Application of 'top' fertilizer was done 5 weeks post-germination. The prerequisite for this fertilizer application was rainfall which unfortunately was erratic and scanty.

Figure 4: Waterlogged crops

f. Pests appeared particularly the armyworm. Warlock TM ADAMA was sourced by the farmer and utilized to control the pests. 40 ml of the pesticide mixed with 20 litres of water and sprayed on top of the plants aiming at the whorl. A knapsack was also procured for this purpose. Spraying was supposed to be done every fortnight but pesticide procurement was often a challenge. Termites destroyed most of the maize stalks and could not be controlled by Warlock TM ADAMA. The price of Warlock TM ADAMA and the termite pesticide was N$1,650.00 and N $1,100.00 respectively was inhibitory for sustainable use of these chemicals.

Figure 5: Flooded field

g. The heat continued and sparse rainfall could not support the crop. Only about 110mm of rainfall was received. The drip irrigation system suffered technical glitches linked to financial challenges the farmer was experiencing. The crop withered or became stunted. Armyworm overwhelmed the crop. It was also noticed that the virgin site was performing worse than the site which was ploughed previously. As if the challenges were not enough, during mid-January to early February over 400mm of rainfall poured over the farm. Suddenly the crop had too much water and there was waterlogging and extensive compaction of the soil. The plant stalks turned dark brown to red.

B) Plot B

a. The developments mentioned above necessitated the establishment of another plot with slightly different edaphic parameters. A number of aspects of the methodology were changed but the conservation agriculture modalities or concepts remained the same.

Figure 6: Planting in Plot B

b. A plot 30 meters x 15 meters was chosen. This area is 450m^2 or 0.045 ha. The soil was loose and loamy. It was deep ploughed by a walking tractor and basins about 30cm cubic were dug. Wire with knots at 75 centimetres was used to site the rows whilst wire with knots 30 centimetres apart was used to site basins. There were 100 (30 ÷ 0.3) basins in a row and 20 (15 ÷ 0.75) rows. Planting was done on the 19th of December 2020. About 500 grams of cattle manure was placed in the basins and some of the excavated soil was sprinkled over the manure to cover 15 cm of the basin depth. This time it was only the family members who provided labour.

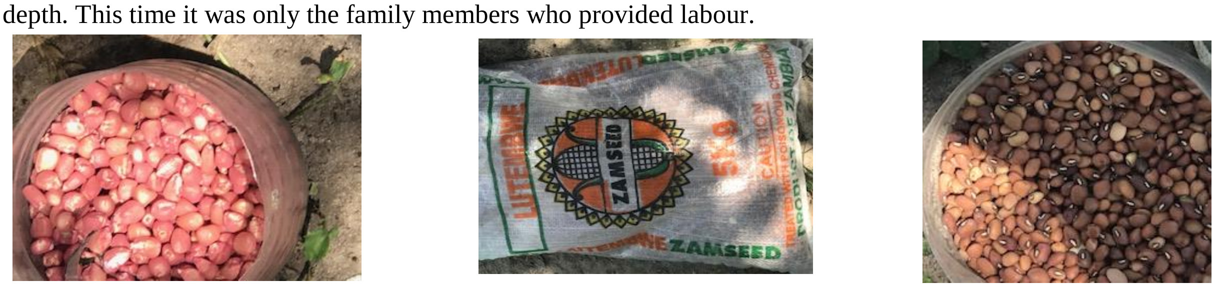


Figure 7: Seeds

Seed (DE303) was planted in the partially covered basin. Three seeds were planted at the vertex angle and the 2 base angles of a virtual isosceles triangle with base and leg of about 20cm in length each. Two seeds of lutembwe cow peas were planted in the middle of the virtual isosceles triangle. The seeds were then covered with soil to make the seed depth soil cover about 10 cm and total cover of the basin 25cm. A simple garden rake was used to cover the seeds. The last 5cm was left as an indentation and filled with mulch.

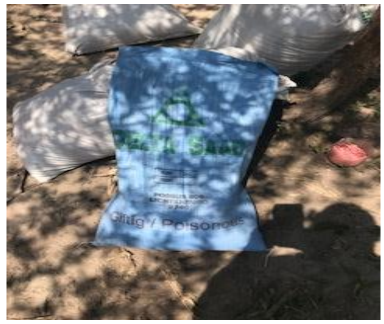


Figure 8: Seeds

Mulch consisted of wood shavings collected from a local carpenter and chipped leaves and maize stover (dead maize destroyed by armyworm and termites).

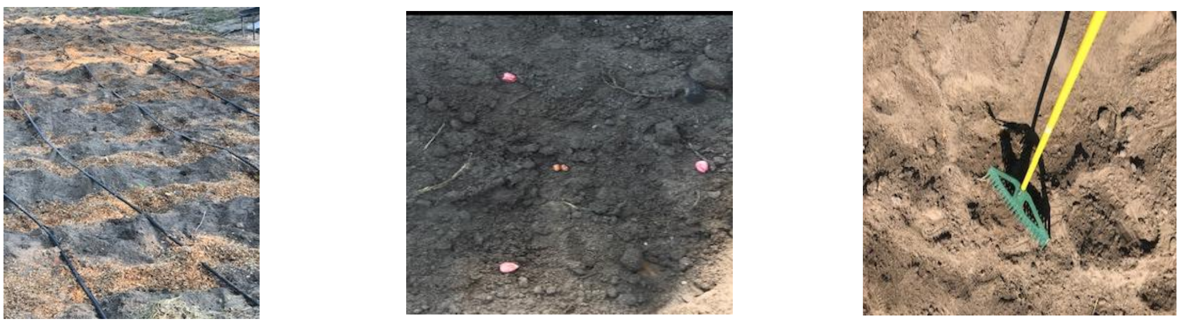


Figure: Mulching

Irrigation was done in the morning; 7 am to 9 am and in the evening; 5pm to 7pm. Each 30 cm drip hole of the drip lines released 4 liters of water per hour. A 2 horse power pump was used to pump water from the excavated dam/well 5 meters deep well with a surface area of $1200m^2$. This deep well / dam / reservoir is a perennial storage water for Tanaka Village. The water was pumped by a 2 horse power single phase pump through 2 filters into a 40mm delivery pipe to drip pipes plugged 75 cm apart.

c. 'Top' fertilizer type 5:3:4 was applied twice; when the maize was at knee height and at tasseling. One coke lid (heap) full of fertilizer was applied to each maize stem about 5cms from the brace roots.

d. Armyworm and termite pesticides were applied every fortnight. The termite pesticides were applied at the base of the maize stems.

e. From the 26th of February 2020, green maize was harvested for family consumption and for sale. About 800 green maize cobs have been sold so far and yielded a gross income of N$4,000.00. Harvesting of green maize continued until the 15th of March. The maize stands now to dry and the maize will be used for maize meal.

IV. RESULTS

A) Yield Analysis

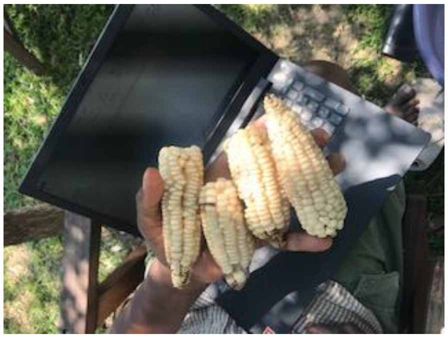
Ten dry cobs were randomly selected and grossly inspected for color, disease, insect damage and immaturity. The cob length measured and an average length was calculated. Number of seed rows per cob was also counted and an average calculated.

One percent (1%) of the maize cobs was diseased. The total number of cobs harvested was 2400. The average length of maize cob was 17.9cm. Average number of seed/kernel rows per cob was 14. This agrees with du Plessis, (2003) who indicated that the number of seed/kernel rows may differ ranging between four and 40, depending on the variety. The average number of seeds per cob was 136, with each seed weighing average 2 grams; bringing the average cob weight to about 272 g (du Plessis, 2003).

B) Analysis of methods of management and yields for Plot A and Plot B

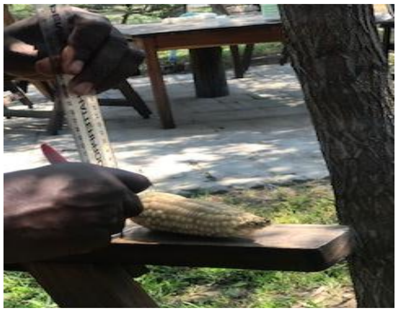
a. Visual appraisal of cobs.

Ten dry cobs were randomly selected from each of the plots and were grossly inspected for color, disease, insect damage and immaturity.



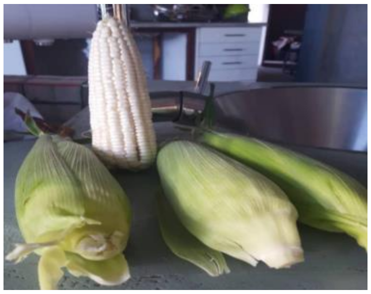
b. Cob size.

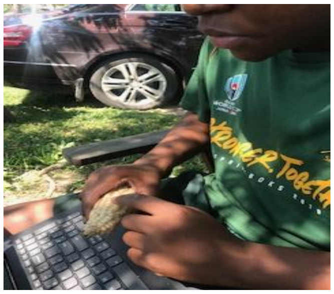
Ten dry cobs were selected from each of the plots and the length measured. A ruler, pen and a flat surface were used to measure the lengths of the cobs. Ten cobs from each plot were measured and an average calculated.



c. Number of seed rows.

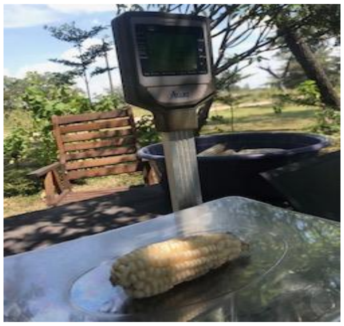
Ten dry cobs were randomly selected from each of the plots, number of seed rows counted and an average calculated.





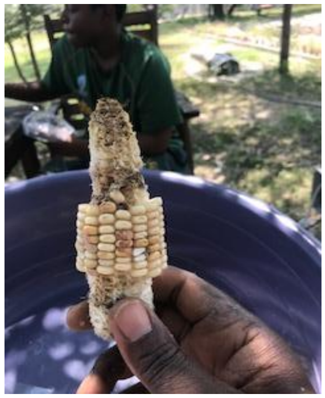
d. Weight of cobs.

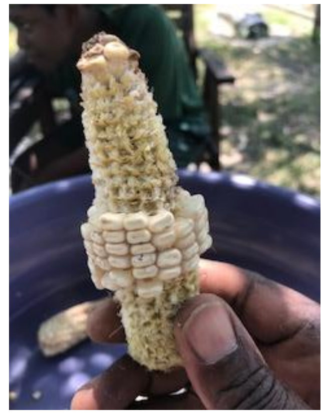
Ten dry cobs were randomly selected from each of the plots and weighed. A digital weighing machine was used. It was shielded from wind breeze in order to keep the calibration unbiased. An average weight of the cobs was established.



e. Weight of individual maize seeds.

Ten dry cobs were randomly selected from each of the plots and the individual seed weight determined. The middle cob seeds were selected for the comparative weighing. Three cobs from each plot were weighed and the number of seeds that would weigh a gram was calculated. The middle seeds in a cob were used because they tend to have the same size. This ruled out bias.





f. Gross maize seed yield of 10 cobs was determined.

Ten dry cobs were randomly selected from each of the plots and the gross maize seed yield determined.

V. DISCUSSION

a. Visual appraisal of cobs

Ten dry cobs were randomly selected from each of the plots and were grossly inspected for color, disease, insect damage and immaturity. The assessment showed more diseased maize originating from Plot A than from Plot B. One percent (1%) of the maize kernels from the latter was diseased. This could have attributed by the stress the maize had from water scarcity and high ambient temperatures.

b. Cob size (length).

Length of cobs was considered as the cob size. The cobs from Plot A were smaller than those of plot B.

Series	Average cob length	Compared to Plot B	Compared to Pioneer 1543
Plot A	12.3	0.67	0.48
Plot B	17.9		0.69
Pioneer*	25.8		

Plot A maize length was only 67% of plot B maize and 48% of the length of Pioneer maize hybrid (Buriro, 2015). The length of plot B maize was 69% of the length of Pioneer 1543 hybrid. This implies that although the management of plot B was superior to Plot A, there were some critical edaphic and/or anthropogenic gaps that depressed optimum productivity in this pilot maize project.

c. Number of seed rows.

Ten dry cobs were randomly selected from each of the plots and the number of seed rows counted and an average calculated.

Parameter	Plot A	Plot B
Average of seed rows in a cob	13	14

The two plots only had a difference of one maize row. This shows that there was potential of high yield if other growth factors were satisfied.

d. Weight of cobs.

Ten dry cobs randomly selected from each plot were weighed and an average established.

Parameter	Plot A	Plot B
Average weight of cobs (grams)	89.8	272.6

The weight of Plot A cobs was 33% of the weight of Plot B maize cobs.

e. Weight of individual maize seeds.

Ten dry cobs were randomly selected from each of the plots and the individual seed weight determined.

Plot	Series	Number of seed weighed	Total weight (grams)	No. of seeds in 1 gram
Plot B	1	64	32	2
	2	101	44	2
	3	95	42	2
Plot A	1	67	22	3
	2	93	32	3
	3	109	32	3

Plot B maize seeds although not at their optimum (in weight), were heavier than those from Plot A. Some of the factors like water depravation that affected plot A could have affected Plot B mildly. The number of maize seeds in a gram was 2 for Plot B maize and 3 for Plot A. The variation in maize seed weight was minimal. This implies that the maize seed weight was insignificant in terms of difference in yield weight for the 2 plots.

f. Gross maize seed yield of 10 cobs was determined.

Ten dry cobs were randomly selected from each of the plots and the gross maize seed yield of 10 cobs was determined.

Parameter	Plot A	Plot B
Total yield from 10 randomly selected dry cobs (grams)	742	2150

The weight of Plot A maize yield from 10 randomly selected maize cobs was 33.5 % of Plot B.

g. Yield per plot and Yield per ha by extrapolation

Parameter	Plot A	Plot B
Total yield from 10 randomly selected dry cobs (grams).	742	2150
Length of plot.	39	30
Width of plot.	16	15
Area in m2.	624	450
Area in hectares.	0.0624	0.045
Number of basins per row.	28	100
Number of rows.	52	20
Average number of cobs per basin	1	1.2
Number of cobs.	1456	2400
Average yield for 10 cobs in kgs.	0.742	2.15
Total yield: kgs /plot.	108.04	516
Yield: kgs / per ha.	1731	11467
Yield: tons / per ha.	2	11
Possible yield tons/ha Foundation for Farming; Zimbabwe.	16.77	16.77
Current yield as percent of ideal.	10%	68%

These observations infer that the major contributor to yield difference of the 2 maize plots was in quantity of maize on a cob, length of kernel, and disease status. The hybrid used gave the same weight of progeny seeds but different quantities of the seed. An investigation of management parameters should be the objective of further research. There is however an attempt to discuss some of the factors that may have caused the production gap and the way forward.

Other observations

A) Plot B:

a. Received more water by drip irrigation,
b. Was deep ploughed before basin digging,
c. Had deeper and wider basins (30cmx30cmx30cm),
d. Had 3 maize seeds planted instead of 2,
e. Had 2 seeds of legumes planted simultaneously with the maize seed to take advantage of their nitrogen fixing capabilities,
f. Had mature cow dung placed copiously in the basins before planting,
g. Had pesticides applied more often (every 2 weeks) and
h. Had termite control done routinely

VI. CONCLUSION AND RECOMMENDATION

Technocrats, donors and project implementers should radically tweak communal farmers to transform the communal agriculture-mindset to a commercial agriculture-mindset in a communal setup.

Beneficiaries should participate in capitalization of their projects. The 'freeloader syndrome', has significantly dampened or ablated the innovative propensity of most beneficiaries. The absence of 'work works' attitude many a time breeds poor sustainability of projects.

In general, individualization of farming or agricultural support should be promoted instead of communal/cooperative support as it enhances focus, creates a huge sense of ownership, upholds responsibility and improves the farmers' propensity to pay back initial capital and extirpates the common freeloader disposition. Individuals should be afforded the opportunity to borrow funds from or be collateralized by the proceeds of natural resource utilization and payback modalities must be initiated so as to create a revolving fund.

Furthermore, the trending communalisation of benefits or sharing of resources may have to be substituted by individualization of entrepreneurial support as studies elsewhere in southern Africa have shown that there is no evidence of the aspired sustainability of ventures where communalized support or benefits were given after cessation of the expert or financial support and in some cases such projects succumb to attrition during implementation, also supported by (Norman, 2012). Similarly, collective action, support and solution generation, unfortunately, has many a time left no success foot print in the Zambezi Region. Contrary to the common assertion that people in rural communities cannot succeed in business or that they should be grouped for a social development goal, studies in Zambia, Zimbabwe and Botswana are showing that big agro-ecological ventures individually and indigenously owned are thriving well (Rozemeijer, Gujadhur, & Motshub, n.d).

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