

POLYTECHNIC OF NAMIBIA



JOINT ACTION RESEARCH AT VASDRAAI FARM BETWEEN RESETTLED FARMERS AND STUDENTS OF THE AGRICULTURE PROGRAM

Funded through the Country Pilot Partnership Programme (CPP)

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Technical Report: NRM/2010/1
December 2010



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Report on Polytechnic visits to Vasdraai Resettlement Farm

INTRODUCTION

The Agriculture program at the Polytechnic of Namibia wishes to provide practical experience for its students to learn from a rural community. Every year, if funds allow, two excursions are undertaken for students to interact with a community, to expose the students to hands-on extension work while encouraging farmers to experiment with sustainable production methods and value addition. In 2010, thanks to funding received from the Country Pilot Partnership Programme (CPP), the visits were undertaken to Vasdraai resettlement farm, where CPP also funded a development project implemented by Komeho Namibia Development Agency.

Before the students registered for their second-semester courses, an exploratory visit to Vasdraai was undertaken by the lecturers on 20-21 May, during which the farmers presented their problems. Those problems that were too big to be managed by students, such as boreholes that needed equipping, were referred to Komeho. The manageable problems were listed together with the names of interested farmers for allocation to individual students. Polytechnic students learn about ways of farming that are sustainable through improved ecosystem functions and services.

Students prepared for the first visit by planning small-scale trials to be managed by farmers and designing data sheets for farmers to keep records on. During their first visit on 16-20 August, the students applied Participatory Rapid Appraisal (PRA) to explore the situation of the community and facilitated the initiation of their trials. All the posters produced in the PRA exercises remained with the community, so the diagrams that appear in this report are copies that were drawn by students.

During the follow-up visit, on 24-28 October, the results of the trials were jointly evaluated. Each student had to arrange for the hands-on interaction to be done by community members, such as by demonstrating the trial outcomes and performing roleplays. These were filmed and shown to the wider community at the farewell party. They have also been copied onto DVD for wider distribution.

Great assistance was received from community members, led by Headman Anton Ouseb, and Komeho staff members, led by Gabriel Hangara.



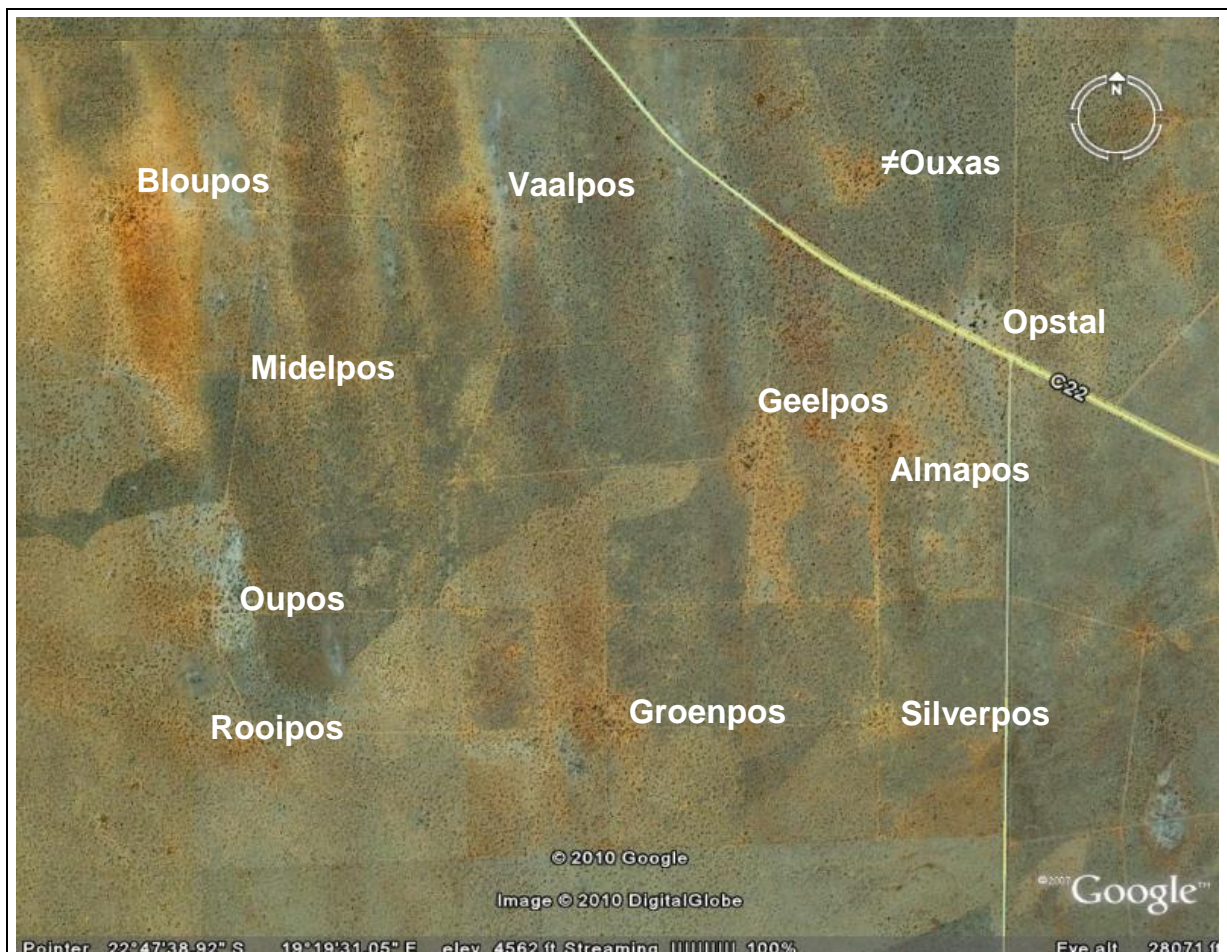
BACKGROUND TO VASDRAAI RESETTLEMENT FARM

A background account appears in the following report:

Hangara, G., Muremi, J., Kalira, E. & Motlaping, B. (2009). Baseline survey: Vasdraai resettlement farm. Report prepared for UNDP and Ministry of Environment and Tourism. Windhoek: Komeho Namibia Development Agency.

In 1996, 73 families were resettled on the former sheep farm of 4300 ha that had previously been owned by a single commercial farmer. This farm is on sandy soil in the Kalahari, receiving mean annual rainfall of approximately 330 mm, which is prone to wind erosion if the perennial grass cover gets destroyed. The sand dunes that run in a north-south direction indicate that the area was under the influence of shifting sands during drier times in the past. These dunes have become stabilized by vegetation, but if this vegetation is destroyed then the dunes will again shift.

The families settled around ten of the waterpoints scattered throughout the farm, as indicated below.



Google Earth image of Vasdraai Resettlement farm, indicating the position of the water points where farmers were resettled (except for Opstal where the farmers were not allowed to settle in the main farm house). Fire scars are visible from the south west to the centre, which had been burnt by an escaped fire the previous year. The main road from Gobabis to Aminuis, the C22, runs through the north east of the farm.

SOME GENERAL PHOTOS



Students are dropped off at various posts, to interact with the farmers living there



The PRA diagrams are interpreted



The audience is attentive



Food is dished out at the party



A film of the interactions is watched



The Polytechnic students and staff set up camp at Opstal

WATER

The Vasdraai farmers are dependent on groundwater, but only three of the posts have boreholes and the pumps, or their engines, were often out of order. Komeho organised the repair of water installations, which will require good care and regular maintenance to keep in order.



Livestock concentrates around the borehole where downward leaching of pathogens from their dung could contaminate the ground water.



An unintended effect of the pit latrines, being installed at Vadraai by Komeho, is that human faeces will be brought closer to the ground water.



The tap at a drinking trough consists of a stopper that blocks the pipe end.



An old bath serves as a drinking trough.



Any overflow from the tank does not get wasted



.... although water evaporates at high rate from an open reservoir.

INTERACTIONS RELATED TO WATER

Use of push tap to avoid water wastage, facilitated by Agricultural Extension student Anderek Shigwedha

It is unclear at which post the student performed this interaction and with whom, since his report was not retrieved. Apparently a turn tap was replaced with a push tap during the first excursion, to avoid wastage of water when the turn tap was left open unnecessarily when children neglected to close it. By the time of the follow-up visit the farmer had apparently removed the push tap, since it was too constricted and reduced water flow too much.

Improving water quality with Effective Microorganisms (EM), facilitated by Agricultural Extension student Mariandekua Muzuma at #Ouxas

It is unclear with whom the student performed this interaction, since his report was not retrieved. Apparently during the first visit two groups of birds were weighed, one of 13 chickens and the other of 4 ducks. They were given some EM in their drinking water (amount and frequency unknown) and reweighed during the follow-up visit. Over the intervening 10 weeks, the chicken group increased from 17.5 to 18.8 kg, while the duck group increased from 6.0 to 9.6 kg. It seems there was no control group to compare with.



Rainwater harvesting for compost-pit garden, by Komeho technician Albert Kahiurika at Tjaka Agricultural Development Centre (ADC), facilitated by Agricultural Extension student Mututa Kaangundue

This interaction was done at the Tjaka ADC due to the unavailability of an appropriate site on Vasdraai. During the first visit a pit of 1.2 m width and 1 m depth was dug and filled with organic matter, moistened and covered with a sheet of plastic. During the follow-up visit the plastic was removed and a variety of useful plants were planted around the pit, including sweet potato vines to cover the pit to keep the compost cool and create a moist micro-environment, and Siratro plants to climb up the *Sesbania* trees, both of which fix nitrogen. The plants can send their roots into the compost when it is ready. Until the composting process has been completed, the roots can grow the other way, into the soil.



Ash is sprinkled onto the pit contents.



Plastic covers the moist contents.



A gutter and down-pipe will lead rainwater from the roof into the compost pit garden.



The compost pit around which a variety of plants are grown, to receive rain water from the roof.



Organic matter is brought to a compost pile, later to be carried as compost to spread onto gardens, in the roleplay.



Exasperation that all the composting work was unnecessary, on finding a compost pit garden in the roleplay.

Low pressure drip irrigation, by farmers Risca and Williem Kamadam at Bloupos, facilitated by Agroecology student Lucas Moongela

This was supposed to be a trial started during the first visit, to measure how well it saves on both labour and water, and prevents the soil erosion that occurs with the commonly applied watering method by bucket. However, the late arrival of funds and slow procurement procedures resulted in the materials not being ready. Therefore the drip system was only installed during the follow-up visit. A 20-litre water container with tap was placed on top of a short post, one metre above the ground, and tied to a taller post to supply water to four lengths of pipe of about 5m each. Drip holes were punctured every 60cm along the pipes. Water gets poured by bucket into the opening at the top of the container and the tap gets turned open for the water to drip out of the holes. The total cost of this drip system came to N\$550.



A drip irrigation system is installed in the garden.



Water is poured into the container, which is carried on a short post and tied to a taller post.



The tap is opened.



Water drips from one of the outlet holes.



Beans are sown at each drip outlet.

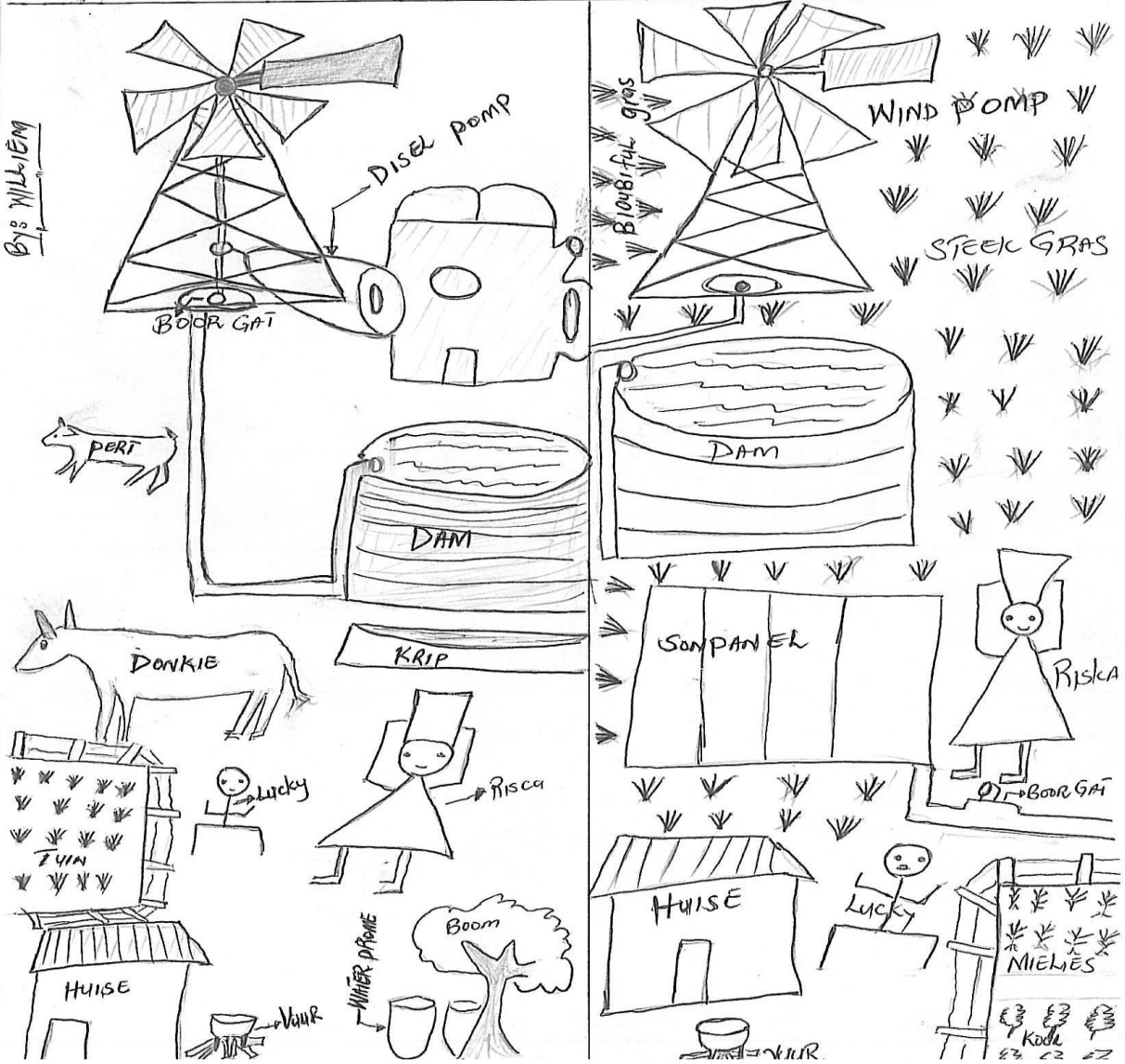


Water is carried to the garden, in the roleplay that illustrates irrigation before and after installation of the drip system.

WATER TREND DIAGRAM (Bloupas)

PRESENT

FE TURE



GRAZING

The threat of overgrazing is the most serious faced by the Vasdraai farmers.



Near Rooipos, where the grazing pressure has been less heavy, the degradation process can be observed as the sizes of bare patches expand



... which will eventually take over the whole area, as has already occurred at Vaalpos where the grazing pressure has been extremely high for many years.



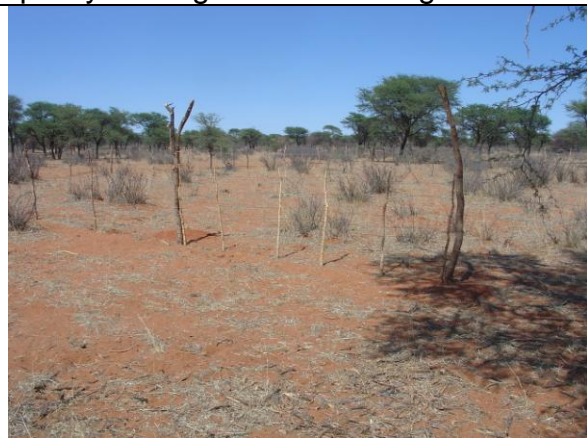
In healthy rangeland the most nutritious grasses grow under large trees, but due to continuous grazing these have been replaced by unpalatable *Sida cordifolia*.



The continuous grazing on the palatable *Melinis repens* tussock will eventually kill it and force animals to feed on the poor quality Steekgras in the background.



The calcrete layer at a depth of about 80cm retains moisture and provides calcium for plant and animal growth.

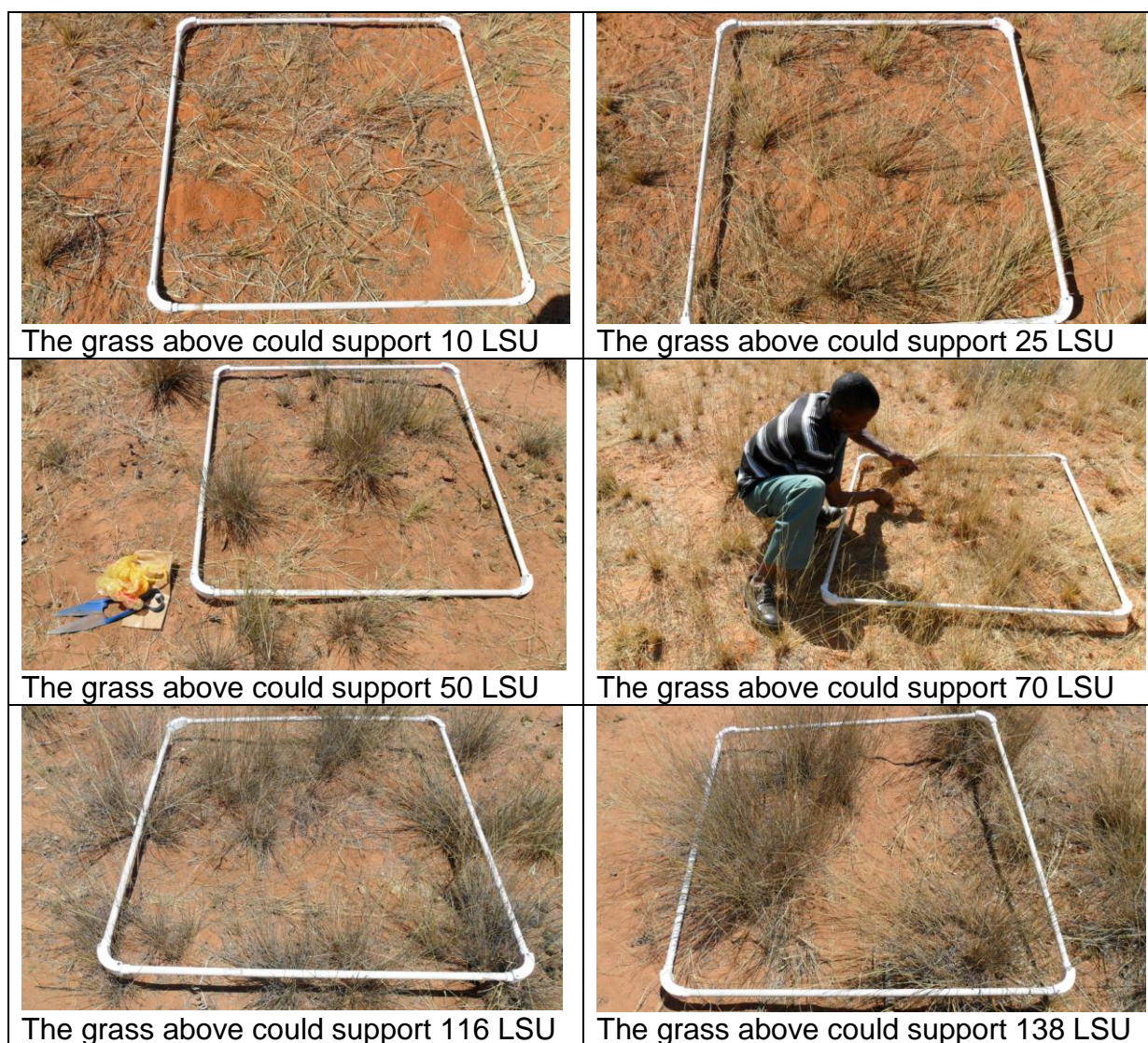


Komeho facilitated the construction of fenced benchmarks that will help farmers make management decisions.

INTERACTIONS RELATED TO GRAZING

Estimation of grazing capacity, by farmer Ruben Uirab at Groenpos, facilitated by Agricultural Extension student Inotila Mwaetako

Photos were taken of grass in different parts of the rangeland around Groenpos, before the grass was clipped within a 1m² quadrat and kept in a labelled paper bag for drying and weighing back at the Polytechnic. The grazing capacity of rangeland in each photo was calculated based on the assumptions that: 1) half of what was clipped could be eaten by cattle; 2) each large stock unit (LSU) requires 13.5 kg of dry grass per day; 3) it may take a full year for new grass to grow; and 4) the livestock at Groenpos has access to 400 ha of rangeland. The number of LSU that could be supported at Groenpos by different amounts of grass appear below.



By far the most common species of grass around Groenpos is Steekgras, which is usually avoided by the animals, so the assumption that half could be available for livestock is actually an overestimate, unless the livestock is supplemented with a source of nitrogen, such as urea. One mature cow, or six sheep, or one donkey may be considered equivalent to one LSU when performing calculations.



Seed cakes for establishing better grass species, by farmer David Tjihumba at Bloupos, facilitated by Agricultural Extension student Hileni Andreas

Seed cakes were moulded on a smooth floor at Opstal. Seeds of *Cenchrus ciliaris* (Bloubuffel) and *Stipagrostis uniplumis* (Boesmangras) were used. These grasses had previously been abundant at Vasdraai, but are now much less common. The seedcakes should only be placed where the grasses are protected from overgrazing.



Water is added to mix with cow dung and soil.



Seeds of Bloubuffel are added to the mixture.



The mixture is then shovelled onto the seed cake mould, to be compacted.



The mould is removed for the next batch of 100 seed cakes



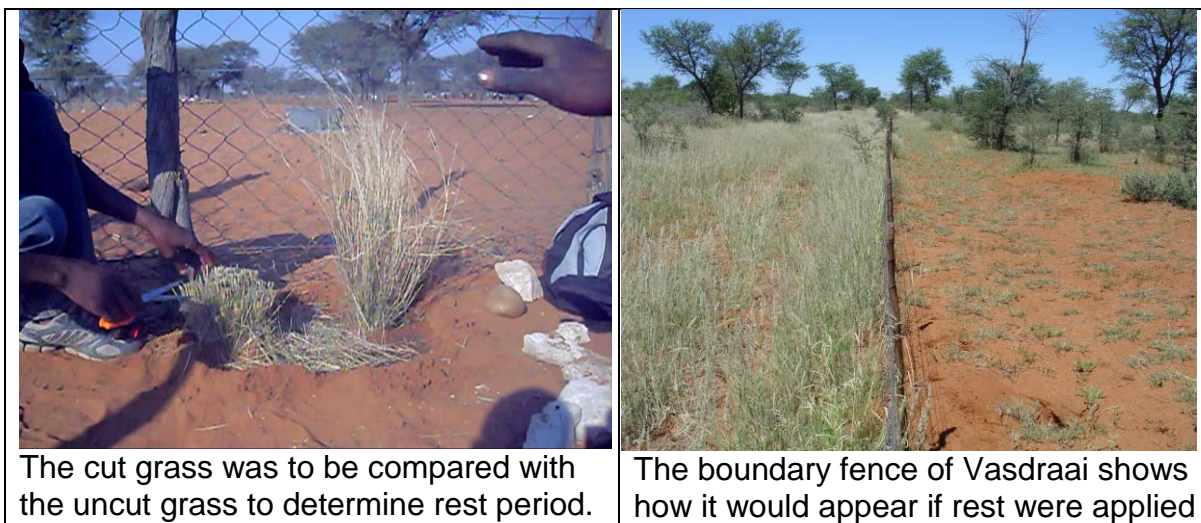
Mr Tjihumba holds seed of Boesmangras at the drying seed cakes



Results from placing seed cakes with Bloubuffel grass in Mr Tjihumba's garden

Regrowth rate of grazed grass, facilitated by Agricultural Extension student Thomas Vernel at Rooipos

Two Boesmangras tussocks of similar size were transplanted into a garden. One was cut low down to simulate severe grazing while the other was left uncut. The intention had been for the regrowth rate of the cut grass to be measured, to determine the length of the rest period that it would require to recover from the cut. However, by the time of the second visit the new occupants of the yard had removed the grasses, unaware of the experiment left behind by the previous occupants.



The cut grass was to be compared with the uncut grass to determine rest period.

The boundary fence of Vasdraai shows how it would appear if rest were applied

Grazing plan for Vasdraai, facilitated by Agricultural Extension student Erkki Moombola

It is unclear what was done and achieved in this interaction, as the student's report was not retained. The student was given a Google Earth image of the farm, on which fencelines were visible, with the instruction to indicate camps that should be grazed and rested at different times as agreed with the farmers. However, he failed to bring the map back with the plan.

Due to the existence of fencing that radiates out from water points, Vasdraai is well suited for a simple grazing plan that would allow grass to recover and therefore regrow much more vigorously and hence produce more animals. Some Vasdraai farmers rotate their animals through camps, but they do this too fast, such as every month, which provides insufficient rest. An easy and effective way to improve the rangeland would be to divide the grazing area around each post in two halves. If materials are needed to maintain the dividing fence, they could be obtained by dismantling the other fences, which would then allow continuous grazing for 12 months on alternate halves. The year-long grazing will ensure that animals obtain access to grasses kept in their most nutritious state, while the year-long rest will ensure that the grasses regrow strong roots so that when they eventually get grazed again they could regrow new leaves very quickly from their strong roots. The changeover time from one half to the other should take place when perennial grasses start flushing their new growth from moisture reserves, usually in August. The benchmarks could be used to demonstrate this on a small scale.

LIVESTOCK

Livestock is the main form of farming on Vasdraai, being the main generator of income and providing meat, milk, eggs, hides, manure and transport. According to the survey conducted by Muremi *et al.* (2009), the average household on Vasdraai had 15 cattle, 28 goats, 10 sheep, 4 donkeys and 2 horses. Extrapolating the cattle figure to the whole farm puts the estimate of cattle then at 1095. At a visioning workshop at Vasdraai in mid 2010, the number of cattle was mentioned as being 2000. Of course the numbers of livestock fluctuate in response to factors such as the need for cash, the availability of water and grazing, the pressure of relatives who want their herds cared for and the outbreaks of diseases.

It is clear that the farm is grossly overstocked and the quality of the grazing that remains is very low. The predominant perennial grass, *Aristida stipitata* or Steekgras, is usually avoided by animals due to its poor nutritional quality and its sharp awns that cause discomfort to animals and lead to eye infections. It only gets grazed by cattle that are supplemented with nitrogen, of which urea is the cheapest form, but even this cannot be afforded by most of the farmers.

The settlement around water points and kraaling of livestock concentrates nutrients where only annual plants benefit, while diluting nutrients in the rangeland. The livestock also causes damage to gardens and crop fields, requiring regular maintenance of fencing from dwindling tree and bush resources.

A diversity of poultry is kept at Vasdraai, including chickens, pigeons, ducks and turkeys, while some love-birds are kept as pets. Parasites and diseases are mostly treated with a range of medicines and poisons, without regard for the consequences to non-target organisms and ecosystem functioning, thus leading to further dependency on such chemical treatments. A few of the farmers apply herbal remedies for some of the ailments of their livestock.



With little grass remaining, the cattle are easily attracted to Camelthorn pods.



A cow chews on old back-pack, presumably trying to extract a mineral, such as phosphorous, from it.

INTERACTIONS RELATED TO LIVESTOCK

Milk hygiene using Effective Microorganisms (EM), by farmer Stephanus Augab at Groenpos, facilitated by Agroecology student Justina Mwafangeyo

Two cows were selected for treatment with EM on the teats and two cows were used as the untreated controls. The treated cows had their teats washed daily with EM and, if infected, EM was injected into the teat using a 50 ml syringe without a needle. Unfortunately, no records were kept of infection on teats, but a deep wound on the teat of a treated cow had healed well by the time of the follow-up visit.



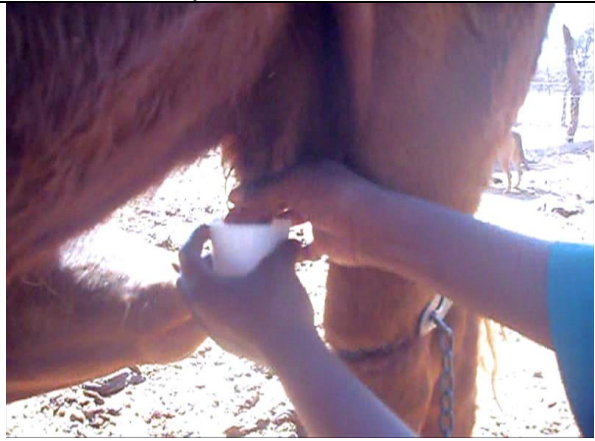
Hands are washed in warm water.



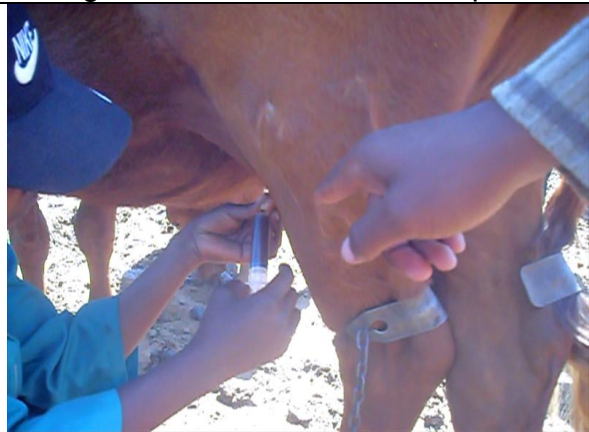
Teats are inspected for infection.



In August a cow's teat had a deep wound



The teat was washed daily with EM.



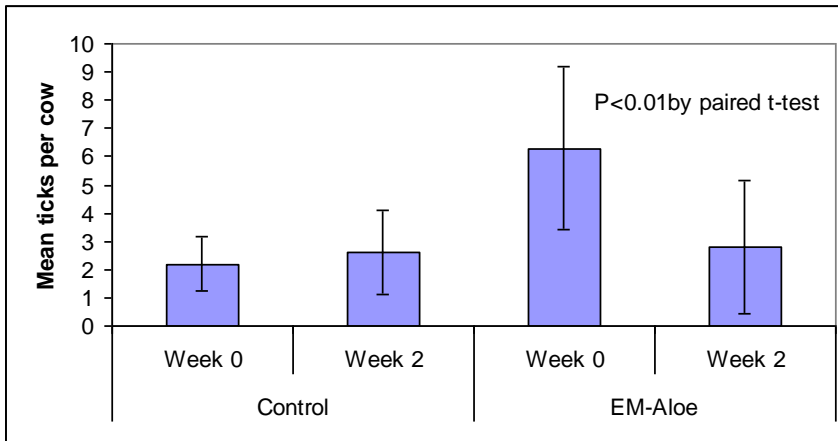
EM was injected into the teat by syringe.



Two months later the wound had healed.

Tick control on cattle using EM-fermented Aloe, by farmer Martha Geingos at Vaalpos, facilitated by Agroecology student Mbava Solly

Ten cattle were sprayed weekly with 250 ml of EM-Aloe and ticks were counted weekly on them and on the ten untreated control cattle. A mistake was made when allocating cattle to the groups, so they were not comparable at the start, with more ticks on the treated group, and records were only kept for the first two weeks.



The average ticks on the control cattle remained at 2, while the average ticks on the treated cattle went down from 6 to 2, a significant reduction. Error bars represent 95% confidence intervals.



Abundant Aloes growing at the Tjaka Agricultural Development Centre.



Chopped Aloe leaves are added to the to EM and molasses for fermentation.

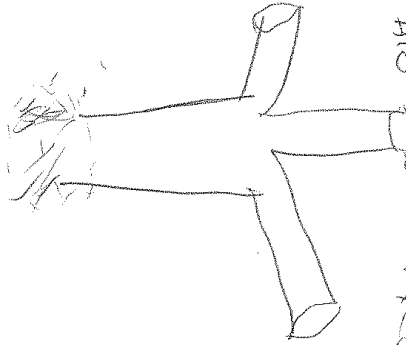


Cattle are herded into the crush for counting ticks and spraying those in the treatment group.



Some cattle escape from the kraal over the broken fence.

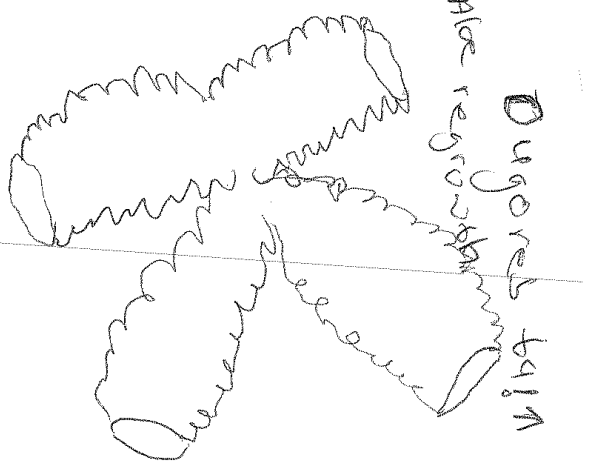
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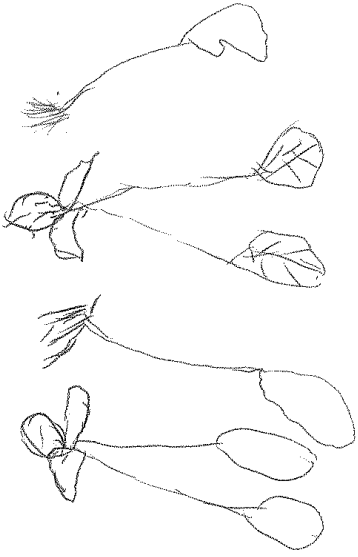
gū yā' wā' pō' hō' hō'
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Alo-~~gō~~ hō' hō' hō'



Dugorebā #gō' hō' hō'
Thinking



BT Celine
yā' hō' hō'

Ihābā sōrē sō' hō' hō'
Ihābā hō' hō' hō'
Mā' hō' hō' hō'



Treating small stock with Effective Microorganisms (EM), by farmer Ms Lettia at Almapos, facilitated by Agroecology student Virginia Radikara

150 ml of EM in 2 litres water was given to 10 marked sheep weekly to drink. They and 10 control sheep were weighed weekly. EM-bokashi was made by fermenting wheat bran with EM and molasses for one month. It was brought along for the second visit, when sheep and goats eagerly ate it.



A sheep is caught for weighing.



Sheep were weighed weekly.



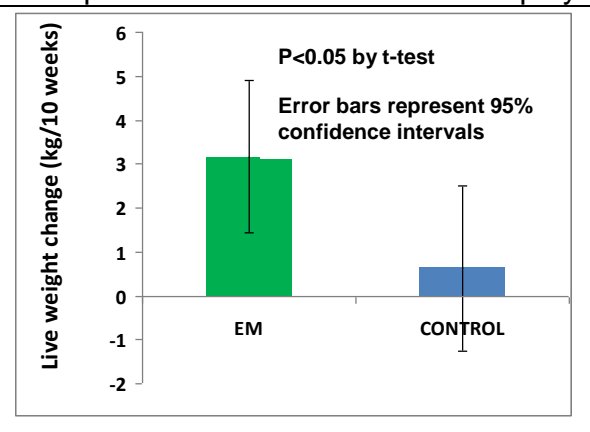
Small stock feed on EM-bokashi.



Sheep herded to EM-bokashi in roleplay



Trial results are explained at the party.

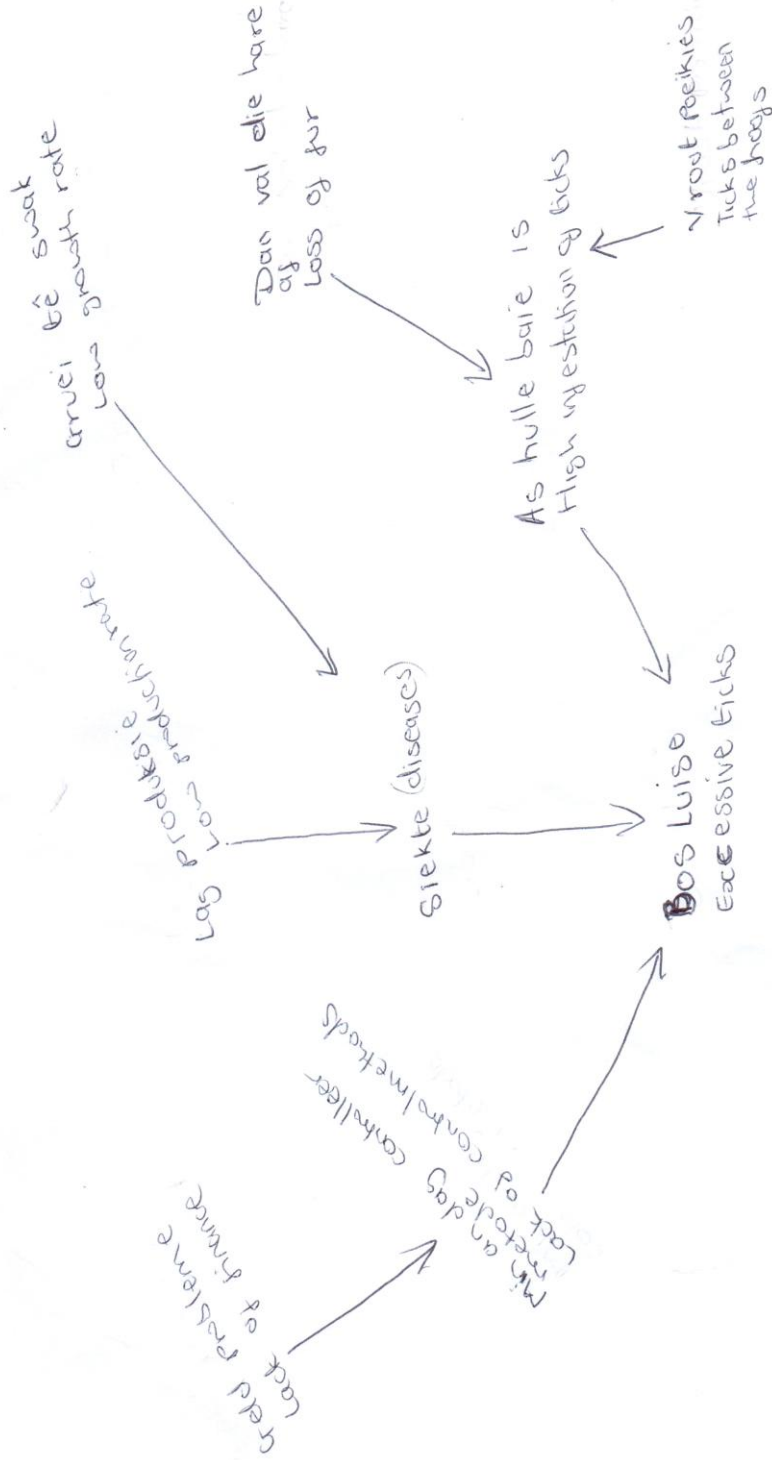


Sheep treated with EM on average grew faster than the untreated sheep.



Five goats that had runny eyes were sprayed around their eyes with 10x dilution of EM. The eyes became better already on the following day.

PROBLEM TREE FOR EXCESSIVE TICKS



By: Mr. Modise

EM as antidote to plant poisoning of livestock, by farmer Abraham Swartbooi at Groenpos, facilitated by Non-ruminant Husbandry student Remisia Ndjaba

Due to the poor condition of the rangeland at Vasdraai, animals sometimes feed on poisonous plants. For example, in 2009 five of the livestock of Abraham Swartbooi became sick from poisonous plants and four of them died. The main poisonous plant at Vasdraai appears to be slangkop (*Drimia sanguinea*), which sprouts from its underground bulb when there is little other green material available for livestock to graze or browse on.

EM was left with Mr Swartbooi for dosing to any of his livestock that becomes sick from consuming a poisonous plant, and more EM was multiplied in a five-litre container for later use. During the follow-up visit it was learnt that one goat had suffered from slangkop poisoning since the first visit and Mr Swartbooi had dosed it twice with EM and it had fully recovered after four days.



A slangkop plant dug up near Groenpos.



The mixture of warm water, molasses and stock EM is poured into a container



..... to be taken into a warm place out of direct sunlight for fermentation for two weeks.

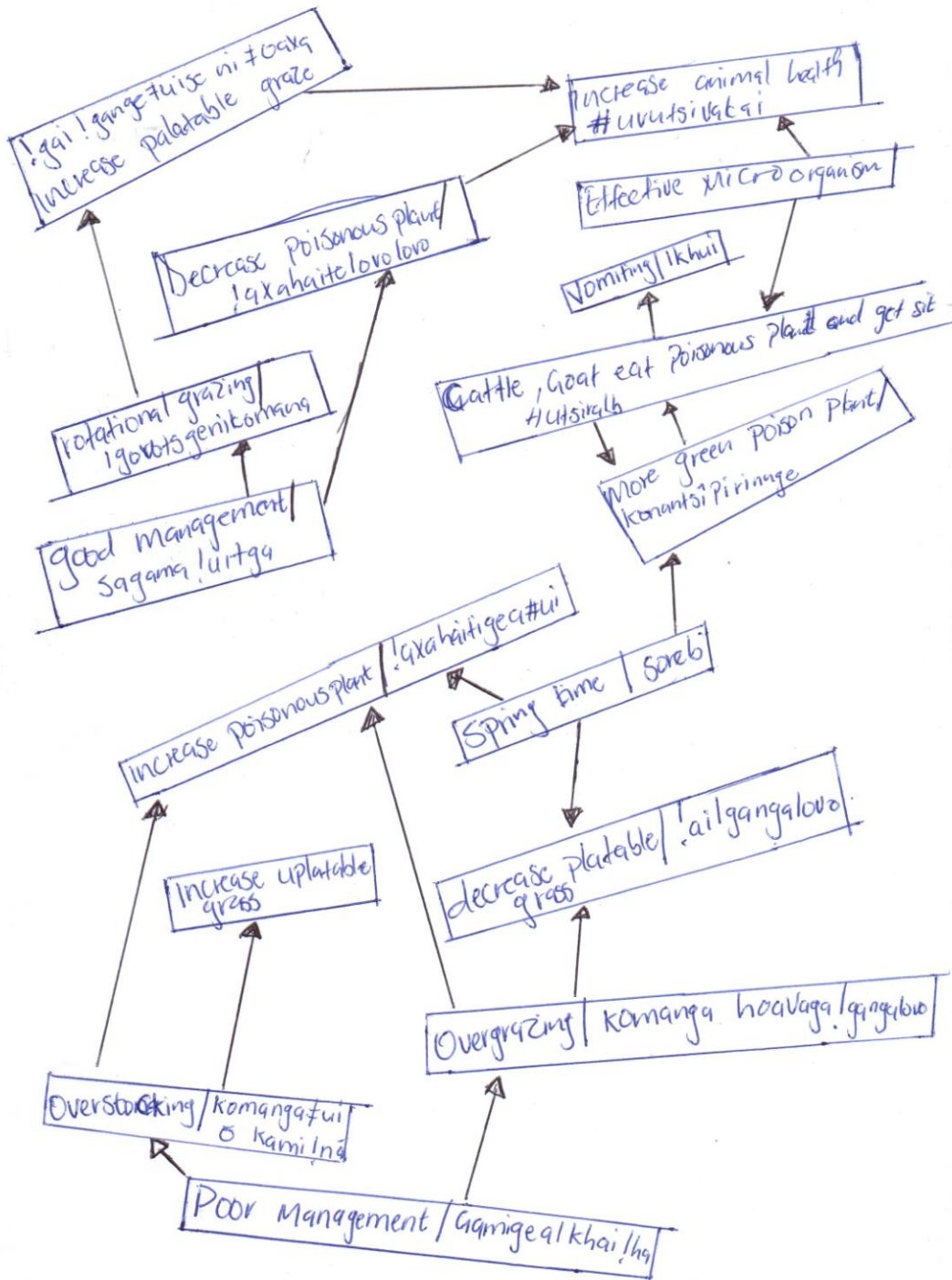


Mr Swartbooi doses one of his goat kids with multiplied EM.

Poison Problem Tree

Remisia Ndjabo
200761498
Non-Ruminant.

By: ABRAHAM SWARTBOOI



Control of intestinal worms in horses using Effective Microorganisms (EM), by farmers Lucky Goagoseb and Mr Ronaldo at Rooipos, facilitated by Non-ruminant Husbandry student Reinold Kharuxab

Dung samples were collected from ten horses and five of them were provided weekly with 100 ml of EM in about 10 litres of water. During the follow-up visit dung samples were again collected from each of the ten horses, and the dung was processed to separate the worm eggs which were then counted under a microscope. There was a significant reduction in eggs of the dung of treated horses, while there was an increase in the eggs of the dung of untreated horses, although this increase was not significant at the 95% level.



An untreated control horse, left, and an EM treated horse, on the right, in the roleplay.



EM is poured into a container for adding to the drinking water for the horse.



The horse drinks from the water into which some EM had been poured.



Dung samples are collected from the treated horses and from the untreated control horses.



Worm eggs are counted in the dung samples at the Polytechnic.

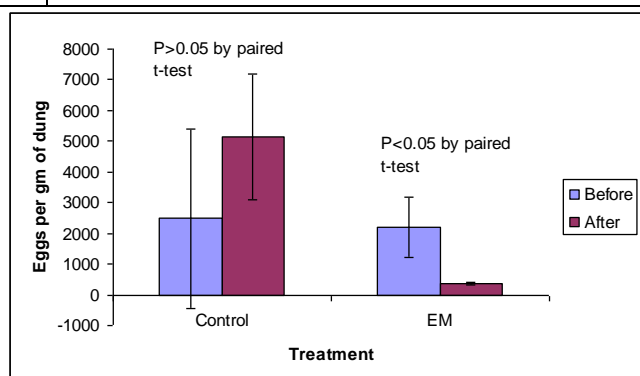


Chart of average parasitic worm egg load of horses before and 10 weeks after treatment with EM. Error bars represent 95% confidence intervals.

Control of chicken lice with Effective Microorganisms (EM), by farmer Hiedi Tsaoses at #Ouxas, facilitated by Non-ruminant Husbandry student Virginia Radikara

Twenty marked young chickens were weighed individually and ten of them were given EM in their drinking water daily while the other ten were left as untreated controls. During the follow up visit the chickens were again weighed and examined for mites. Between the two visits, three of the control chickens died and one of the EM chickens died. None of the EM chickens had mites, while all of the surviving control chickens had mites. The EM chickens gained significantly more weight than the control chickens.



Wheat bran is mixed with EM and dilute molasses for the making of EM-bokashi.



After the mixture is pressed down into a strong plastic sack, newspapers are placed on the top to absorb excess condensation water.....



... and the sack is then tied and kept in the shade for six weeks to ferment.

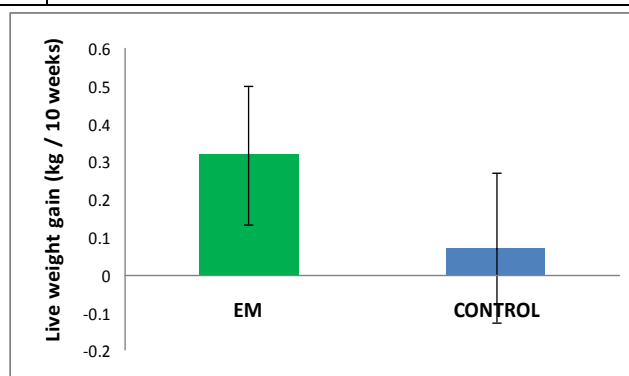
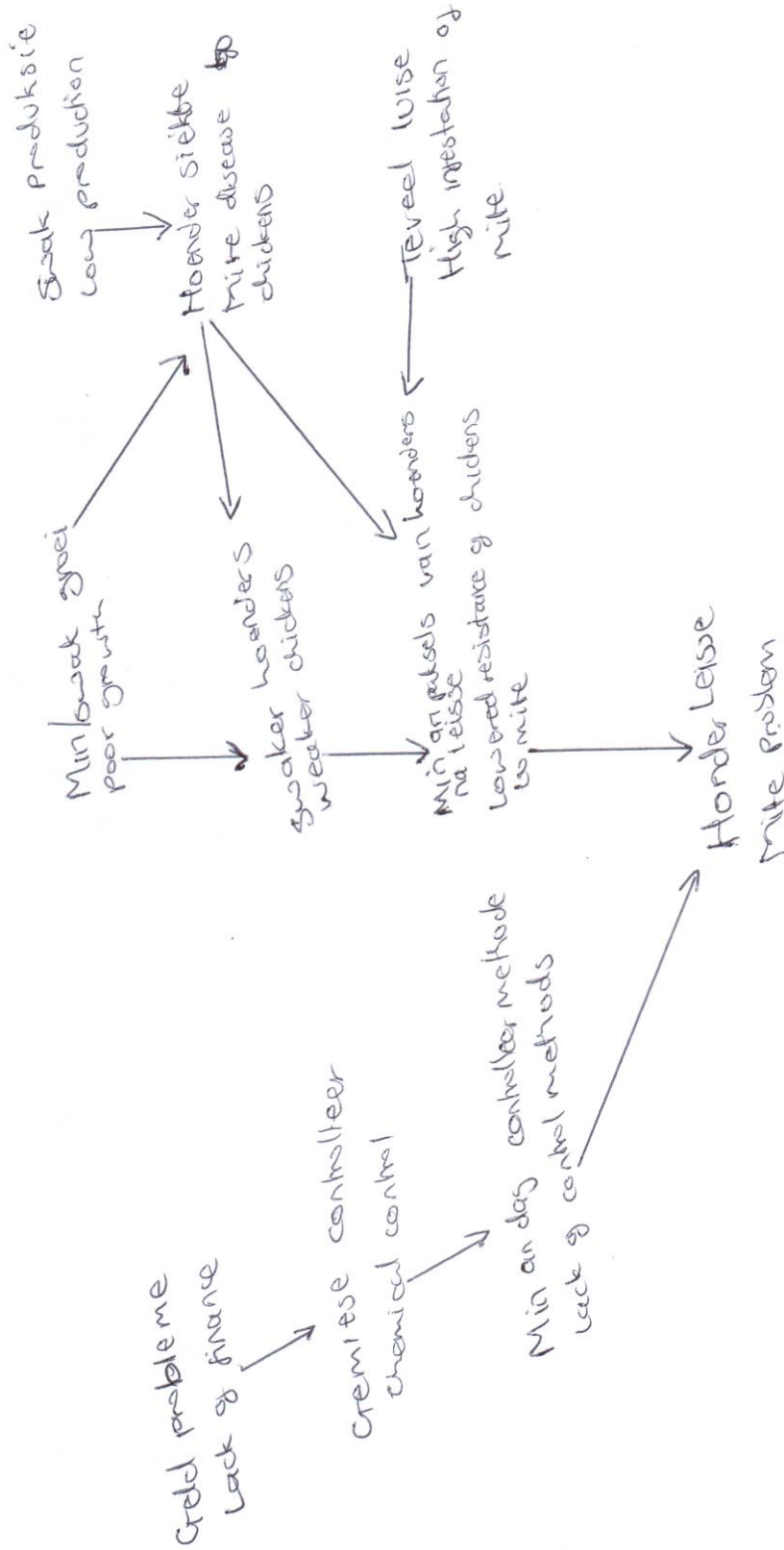


Chart of average change in liveweight of young chickens between the two visits. The difference between the EM treated chickens and untreated controls is significant at the 95% level by t-test. The error bars represent 95% confidence intervals.

Control of blue ticks on sheep, by farmer Willem Swartbooi at Silverpos, facilitated by Agricultural Extension student Emma Lirumbu

It is unclear what was done and achieved in this interaction, as the student's report was not retained.

PROBLEM TREE FOR MITG



By: Ms. Heidi

Control of outgrown goat hooves, by farmers Ruben Uirab at Groenpos, Lazarus Hoebeb at Silverpos and Ms Lettia at Almapos, facilitated by Agricultural Extension student Lucia Kevanhu

Since the soil is only sandy and there are no rocks at Vasdraai for goats to walk on to trim their hooves, there is a need for farmers to perform this function and trim the hooves for the goats.

Outgrown hooves of goats were trimmed and pieces of dung and sand trapped between the hooves were scraped out. The goat at Almapos was suffering pain from its grossly overgrown front hooves that forced it to limp along on its front ankles. Immediately after the hooves were trimmed, it resumed walking on its relieved hooves.



A piece of hoof flies as the hoof of a goat is clipped at Silverpos.



At Almapos, a goat was walking on its front ankles due to the pain from grossly overgrown hooves.



Some parts of its hooves were clipped
.....



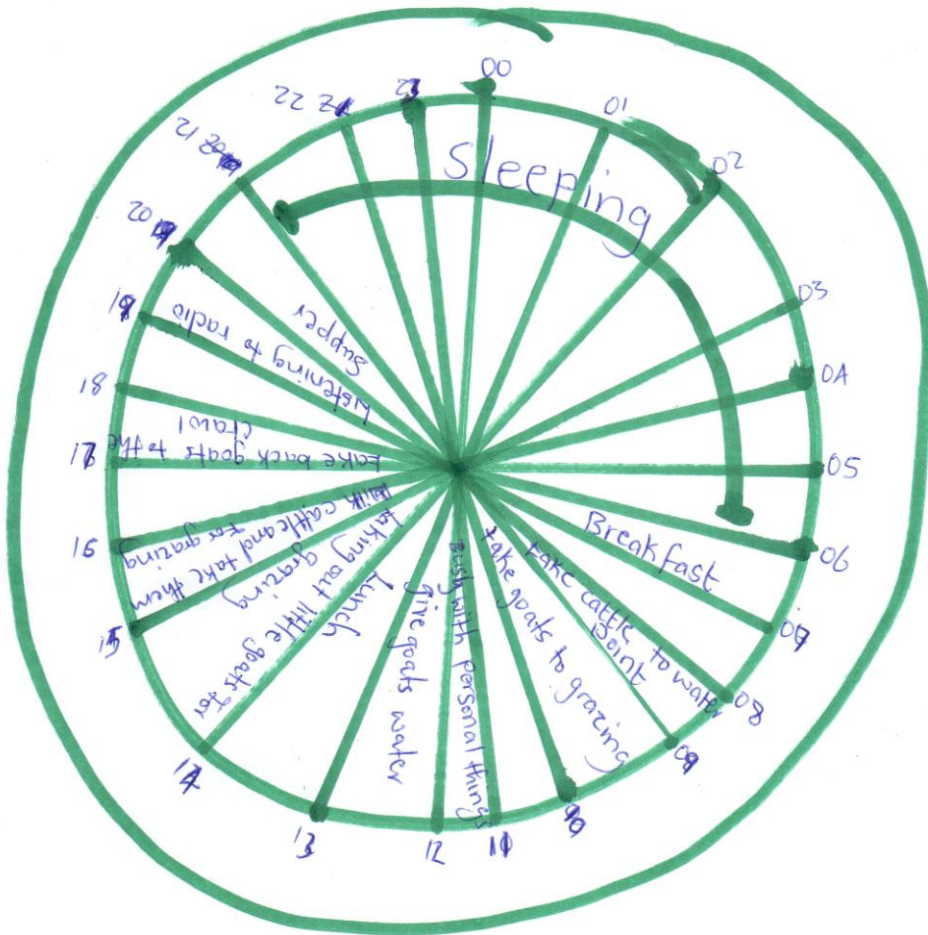
.... but a hack saw was required to remove the thick part of the overgrown hoof.

The PRA diagram appears on the following page

Control of uterus expulsion by cows, by farmer Arnold Swartbooi at Groenpos, facilitated by Agricultural Extension student Kitso Baitshoki

This seems to have been just a discussion, without any hands-on interaction. The recommended actions to avoid uterus expulsion are to avoid exposing cows to bulls that are much bigger than them, to ensure that cows receive adequate nutrition and to vaccinate heifers and cows against brucella.

PRA: CATTLE DAILY CLOCK



Kevanhu Lucia N L

By: ~~Lucky GARUHAB~~

By: lucky * GARUGAB

Introduction to turkey farming, by farmer Helena Kahoro at Rooipos, facilitated by Non-ruminant Husbandry (NRH) student Justina Mwafangeyo and Abner Kashowa

To diversify the farming activities, a male and a female turkey were provided to the farmer and appropriate housing was constructed.

Introduction to duck farming, by farmer Betty Schreuder at Rooipos, facilitated by NRH student Elize Eiphas and Agribusiness Management (AbM) student Julius Fink

To diversify the farming activities, one male and one female duck were provided to the farmer and appropriate housing was constructed.

Introduction to domesticated guinea fowl farming, by farmer Elizabeth Gaes at Rooipos, facilitated by NRH student Lucas Moongela and AbM student Hileni Heita

To diversify the farming activities, one male and two female guinea fowls were provided to the farmer and appropriate housing was constructed.

Introduction to rabbit farming, by farmer Helena Kahoro at Rooipos, facilitated by Non-ruminant Husbandry student Joseph Mutero and AbM student Beatrix Alweendo

To diversify the farming activities, one male and two female rabbits were provided to the farmer and appropriate housing was constructed. Out of the four introduced species, rabbits are the only ones that reproduced by the time of the follow-up visit. First four, and then six, rabbits were born, but four of the latter died. The male rabbit escaped and it will take five months for a newborn to reach maturity to replace it.



The female turkey is attended to.



Betty Schreuder releases her ducks.

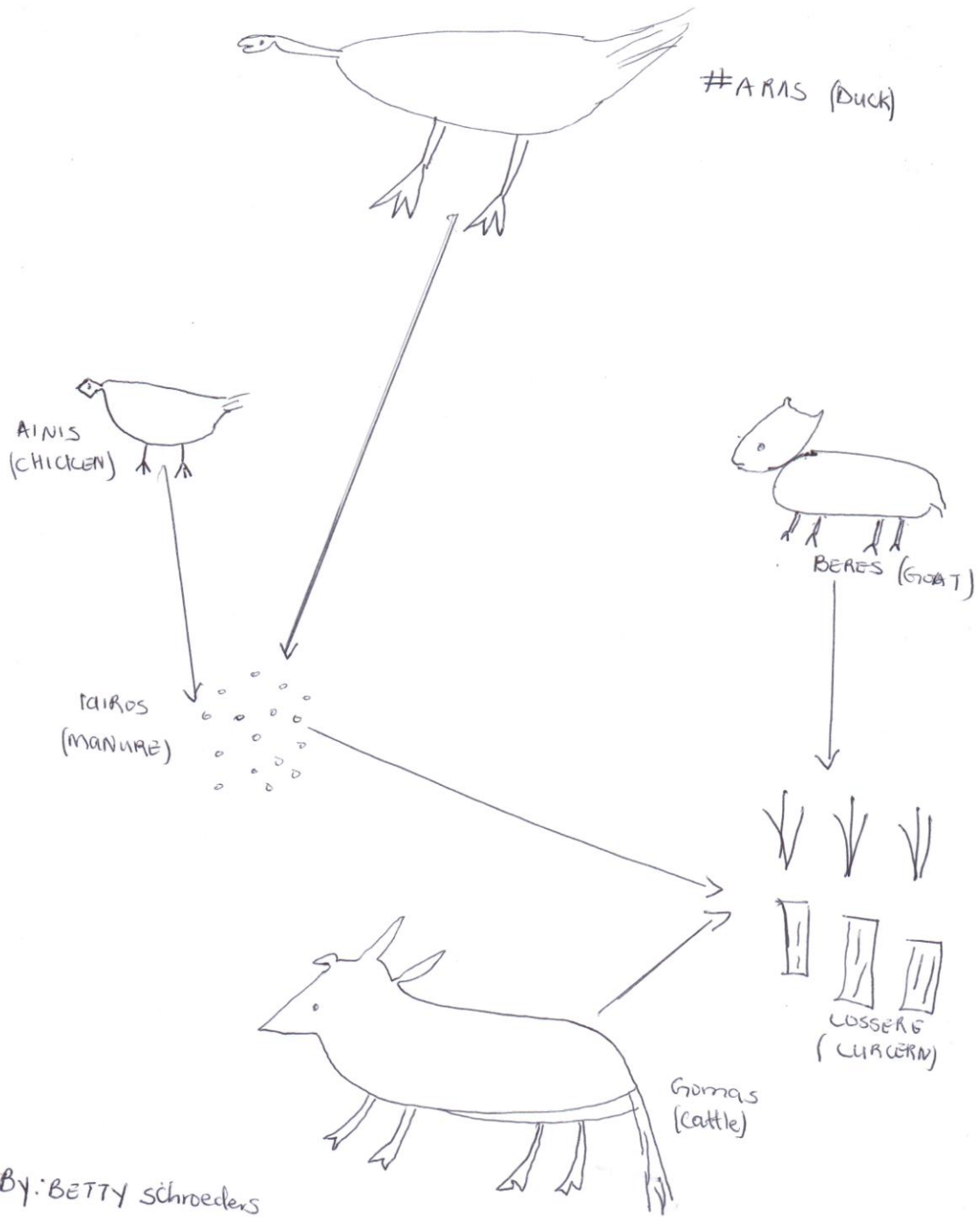


The guinea fowls are attended to.



The floor to the rabbit house is plastered

LIVESTOCK IMPACT

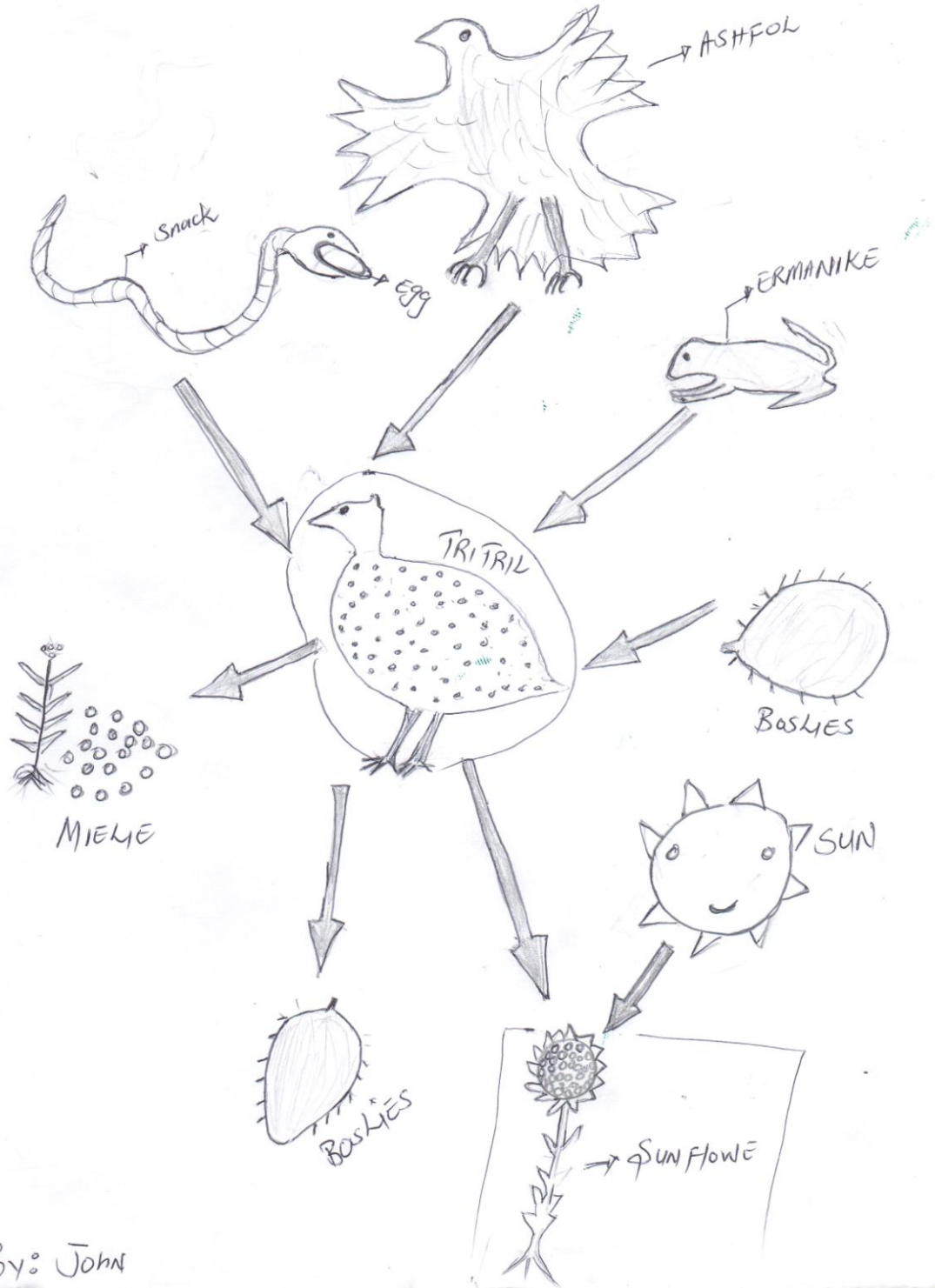


By: BETTY Schroeders

Copied: ELIZE ELPHAS

GUINEA FOWL IMPACT LINKAGE (Rooi pos)

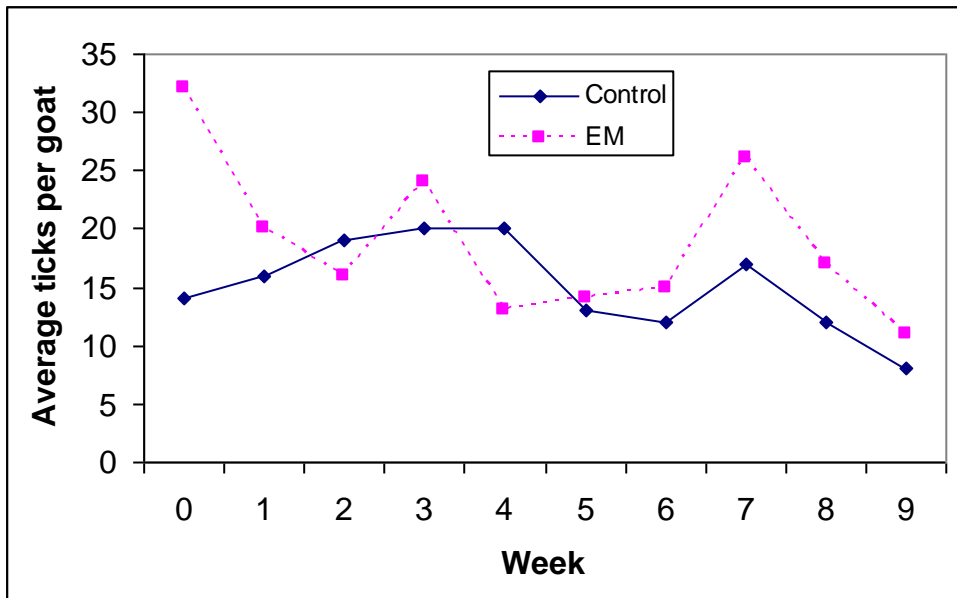
WAS MOONGELA



By: John

Tick control on goats, by farmer Issaskar !Gaoseb at Silverpos, facilitated by Non-ruminant Husbandry student Mbava Solly

Out of six goat kids, the three that had the most ticks were selected to be sprayed weekly with about 50 ml of EM-5, which had been produced by fermenting EM, molasses, grape vinegar and vodka six weeks earlier. The number of ticks were counted on both the treated goats and the untreated control. After the first week the ticks on the treated goats fell to almost the same level as on the control goats, and remained there for the remaining eight weeks.



A goat kid is marked with an ear tag.



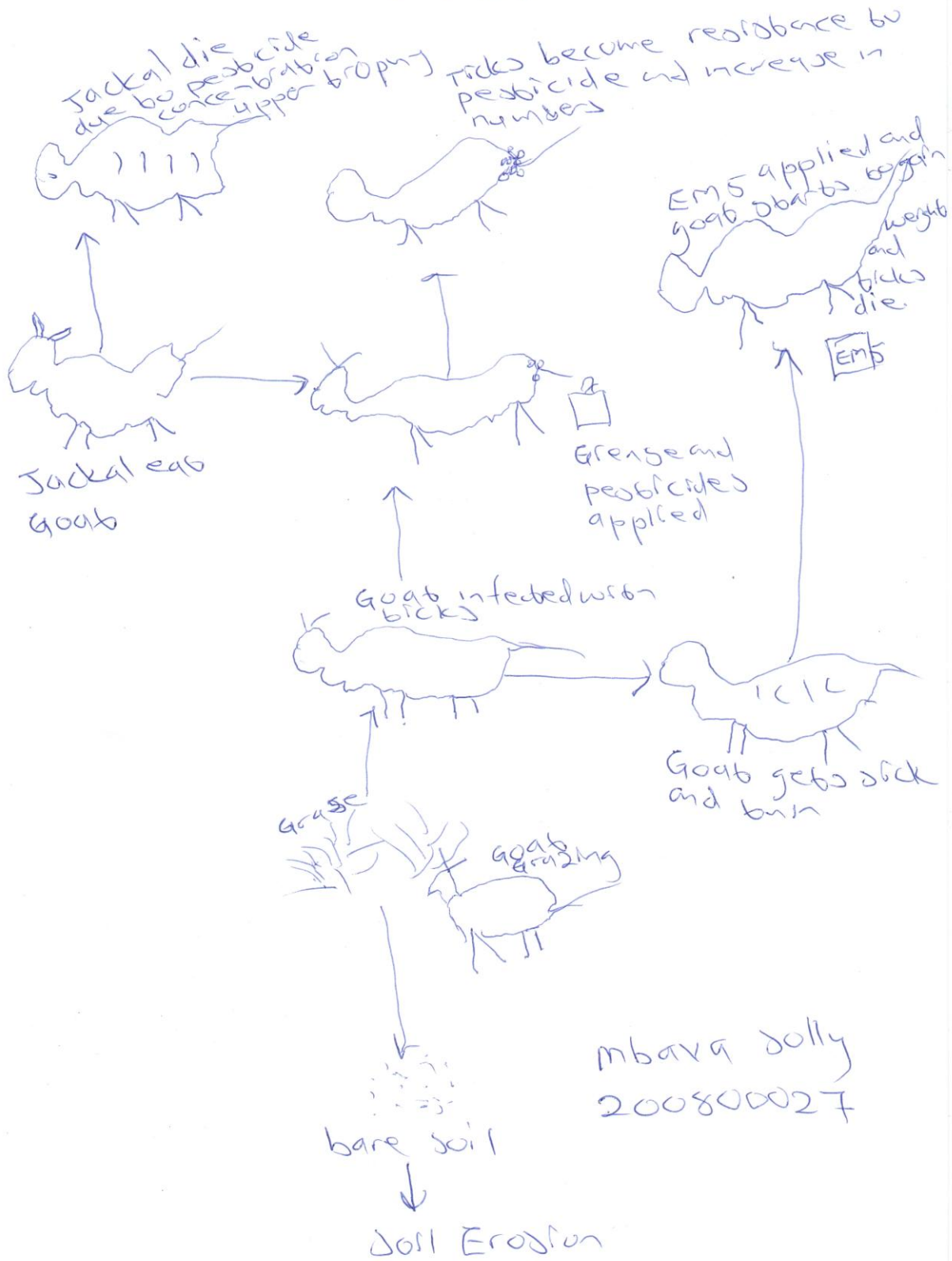
EM-5 is sprayed under the kid's tail

The PRA exercise appears on the following page.

Control of horseflies using EM, by farmer Issaskar !Gaoseb at Silverpos, facilitated by Agricultural Extension student Benita Elago

One horse was sprayed daily with EM-5 and another remained unsprayed as the control. The treatment was perceived to have been unsuccessful. The student had the wrong impression that the EM-5 was supposed to kill the horseflies, rather than repel them.

GOAT LINKAGE EMPACT



VELD PRODUCTS

Although some of the older generation still make use of the wild foods and medicines that used to be so important for the community, a lot of the younger generation disregarded them in favour of modern foods and medicines. This might be later regretted, as some of the wild foods and medicines are not only cheaper than the modern alternatives, but also healthier in many cases. The visits to Vasdraai did not coincide with the season of wild foods, such as the Kalahari truffle (!naba), so the interactions were only based on wild medicines and non-edible products.

INTERACTIONS RELATED TO VELD PRODUCTS

Medicinal use of Vaalbos (*Tarchonanthus camphoratus*), by farmer Justine !Gaoses at Silverpos, facilitated by Agricultural Extension student Pendapala Nuuyoma



Vaalbos on the neighbouring farm, Netso.



Burning coals are placed on dried Vaalbos leaves



.... and the resulting smoke inhaled.



Vaalbos tea is gargled.



Modern medicines are condemned



... while Vaalbos is praised.

Medicinal use of *Senna italica*, by farmer Lazarus Hoebeb at Silverpos, facilitated by Agricultural Extension student Kristofine Kantana



Senna italica is abundant at Vasdraai as it is unpalatable to livestock.



The plant is dug around, to pull up with a lot of the root attached.



The above-ground parts of the plant are discarded



.... and the root is boiled in water.



The resulting tea is poured into a beaker ...








... and the tea is sipped to relieve stomach ache.

200900323

Kristofine Kantana

MATRIX AND RANKING OF YIELD PRODUCT AND THEIR USES

Plant Species	Drawings	# Hu-i Food	Sums Shade	/hurain # hu-i FIRESTICKS FOOD	/haen FIREWOOD
Sennaticq black STICK		●	●●	●●●	
Leo stick		●	●		
Melk bos		●			●●●
VAIBOS		●	●●●	●●●●●	●
Drare am Stalks		●			

key

●	□	Poor	□	●●●	Excellent
●●	□	Average	□	●●●●	Good

AGROFORESTRY

Both indigenous and exotic tree species provide valuable products and services.



Many poles and droppers are used on Vasdraai, mostly harvested from the surrounding rangeland.



Camelthorn (*Acacia erioloba*) seeds germinate well from dung of animals that consumed the pods, but the seedlings do not get a chance to grow into replacement trees, due to continuous grazing by livestock.



Even the attempts of a Camelthorn stump to resprout are prevented by the ever-present livestock.



A Camelthorn is being strangled by wire wrapped around it for anchorage.



Prosopis is irrigated in a garden, despite its poor water-use-efficiency.



Banana trees waste water and their leaves get tattered by the strong wind.

INTERACTIONS RELATED TO AGROFORESTRY

Pruning of Geelhout (*Terminalia sericea*), by farmer Gideon Pakarae at #Ouxas, facilitated by Agribusiness Management student Johannes Gideon

Young trees often develop a bushy growth habit, by sprouting many side branches. If most of the side branches are cut off, then the main branch of the pruned tree is more likely to grow upright at a faster rate into a shape suited for providing straight poles. A young Geelhout tree was therefore pruned near #Ouxas.



Poles of Geelhout are stacked at Silverpos.



Poles are used for fencing and building.



A young Geelhout tree was pruned by removing the lower branches, to encourage faster upright growth more likely to provide straight long poles.



Pruned Geelhout trees on a commercial farm.

Promotion of the Moringa tree, by farmer Kiwit Kanab at Rooipos, facilitated by Agricultural Extension student Hileni Heita

Seedlings of *Moringa oleifera* were provided by Komeho and distributed to farmers during the first visit. Its diverse products and services include human food that is rich in anti-oxidants and purification of water. For the follow-up visit some leaves were harvested, dried and then taken along to Vasdraai. After visiting various homes where Moringa had been planted, the farmer whose tree had grown the tallest was selected for the demonstration on how the dried leaves can be cooked. This farmer was Kiwit Kanab, who had planted the Moringa tree in his field and built a strong protection around it using sticks. The dried Moringa leaves were crushed to become flour. A soft porridge was then cooked using this Moringa flour, sugar, maize meal and fresh milk, which was very tasty and nutritious.



A Moringa tree at Rooipos.



A Moringa tree at Almapos.



The protection provided by Mr Kanab for the Moringa tree in his field.



The Moringa tree of Mr Kanab.

By: Heita Hileni S.P (200150503)

Rooifos Community Food Ranking Matrix

Drawing	Name	Food	Livestock	Medicine	Keys:
	Pere	X X X X	X	X X	Food for people
	Bread mai	X X X X	X X X	X	X X X X
	Porridge meat //hani meat	X X X X	X	X	Livestock
	//hambab	X X X X	X X X	X	Medicine
	tradi...Cabbage //habas MUSHROOM	X X X X	X X X	X X	X X
	//hues Acacia Meritara	X	X X X	X X	None
	//hieb fox	X X X X	X	X	X
	loab pangalin	X X X X	X	X X	X X
	dai milk	X X X X	X X X	X	X

Mulching of fruit trees to avoid termite damage, by farmer Bertha Gaogoses at Almapos, facilitated by Agroecology student Remisia Ndjaba

Termites perform useful ecosystem functions, such as fertilizing the soil and providing food for chickens and guinea fowls. Most termites prefer to feed on dead wood, but if wood is cleared away then the termites are forced to feed on the bark of live trees. Therefore three different types of mulch were tried around mango and orange trees to see if they would benefit from termites without damage to the trees. The grass and paper attracted termites but regrettably the farmer applied poison.



A scorched earth policy is applied around apricot trees, forcing termites to feed on the bark of the trees and on wood in the surrounding fence.



The response of the farmer is to apply lots of carbamide dust, unaware of the harm this causes to ecosystem functions and the health of humans and livestock.



Ash is applied as one of the treatments.



Newspapers are applied as another.



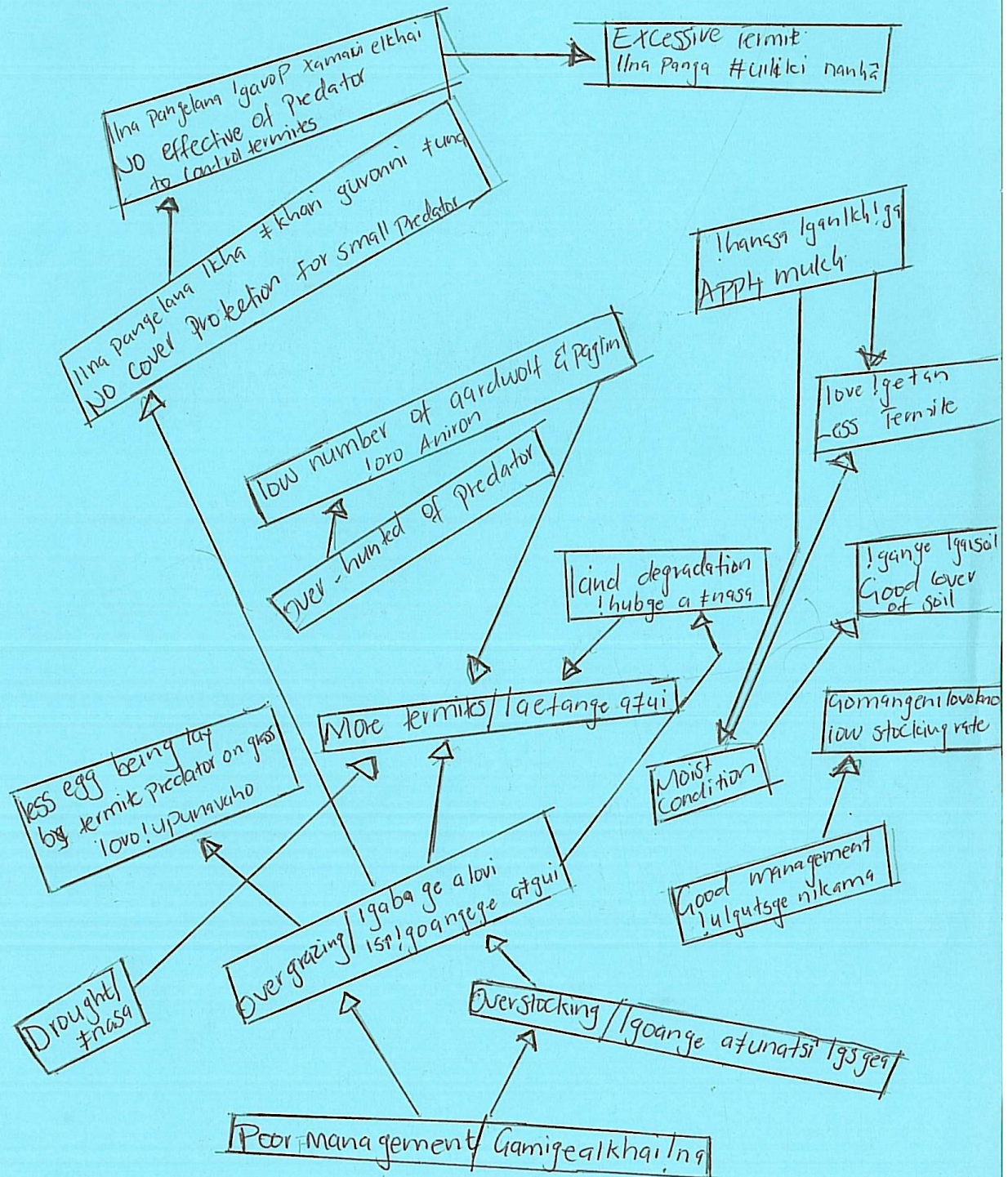
Cut grass was applied as another of the mulch treatments.



Interaction between farmer and student during the roleplay.

TERMITE PROBLEM TREE

By:
BERTHA . G.



Pruning of citrus trees, by farmer Mr Modise at Almapos, facilitated by Agricultural Extension student Sem Kashimba

Most, if not all, citrus trees at Vasdraai had originally been planted as budded orange trees. However, due to lack of pruning, the more vigorous root-stock shoots outcompeted the budded shoots, thus converted the trees to rough-lemon trees. On the older trees there were no more stems that originated from budded shoots, so they will not produce oranges, but the trees were still pruned to increase the size and quality of the rough-lemons that will be produced. Only the orange trees planted in August could be saved, but they will require regular follow-up pruning.



In August the lack of leaves exposes the many stems that grew out from the root-stock of this rough-lemon tree.



Pruning of this citrus tree at least reduced the stems, but it was too late to save the original budded material.



In October more trees are pruned.



Pruned material is left as mulch.



An orange tree planted 10 weeks ago already has long root-stock shoots.



The root-stock shoots are pruned to ensure that oranges, and not rough lemons, will be produced.

RES \$ SHRUBS MATRIC DIAGRAM

OMITIE

	Embonde	Omsiana	Omyapu	Omkababo	Ozome	Ompary	Ovaziana	Ovlenare	Granad	Ozevaka	Ovika Kator
JUNGURISA											
OZONGUNE	XXXXX	XXX			X						
MATURIE	XXXXX	XXX	XXX			XX	XX	XX	XX	X	
OTUTIE			XXX	XXXX							XXX
OZOGOMBE	XXXXX	XXX	XXX			XXX	XX				
OZOGAMBO	XXXXX	XXX	XXX			XXX	XX	XX			

O TJUARERO TJOUNYOSE TAJUKARAMENEP0 OUNANDENGU WOMITI

XXXXX → Ominandengu tjinene
 XXXX → Ominandengu tjinene
 XXX → Kaminandengu vlungurisiwa
 XX → Kaminahepero posya katurihepwa
 X → Tuungurisa posya katurihepwa

Prepared by: Mr: G Palcarae farms
 Student: ~~Baj~~; Sem Kashimba

Neem tree for control of insect pests, facilitated by Agricultural Extension student Justina Totadimwe

It is unclear where this trial was done and with whom. Some leaves of the Neem tree were fermented with EM and brought along to Vasdraai for the first visit. This fermented plant extract was sprayed regularly onto plants in a garden. It is unclear which type of plants were sprayed and how often the Neem extract was sprayed. According to the student, by the time of the second visit, most of the unsprayed plants had died while the sprayed plants had grown well, but there were no records to provide the evidence.



Over view of a young Neem seedling.

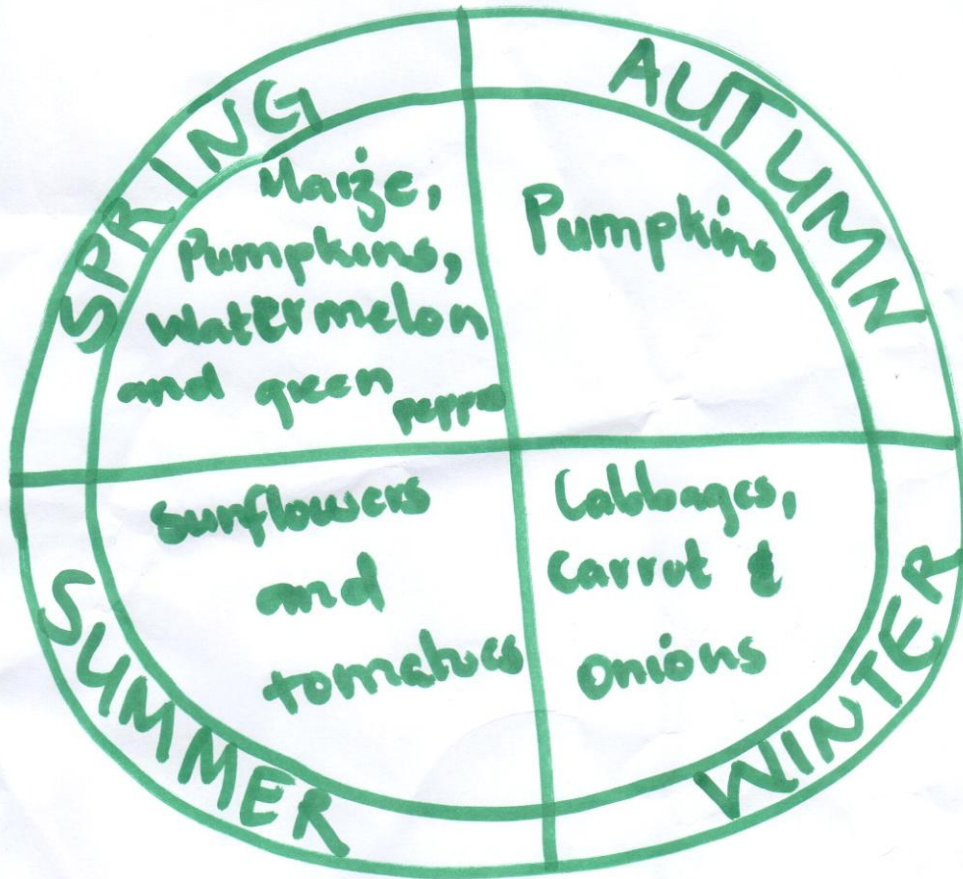


Under view of Neem seedling with a mature Neem tree on the right.

Growing tomatoes among prickly pear, by farmer David Tjihumba at Bloupos, facilitated by Agricultural Extension student Beatrix Alweendo

During the first visit, tomato seeds were sown in two plots, one an exposed plot and the other with prickly pear plants growing in it. By the time of the second visit only one weak tomato seedling survived among the prickly pears, while all seedlings that emerged in the exposed plot had died.

Garden Season- ALITY CHART



By: David Tihumba

Student: B.N. Alweendo
200900404

CROPS

Conventional crop production is very risky at Vasdraai, due to unreliable rainfall. Therefore conservation farming is being tried by Komeho on the communal field of 3ha at Opstal, which had been abandoned by the Vasdraai farmers due to theft of part of the fencing wire. After the fence was repaired, Komeho facilitated basin tillage by community members on one part of the field and deep ripping by tractor on another part of the field, so that farmers may compare the methods and the results achieved by each.

Local suppliers sell seeds coated with fungicide, which also kill beneficial fungi, and mostly sell hybrid seeds that make the farmers dependent on buying new seed every year. Some open-pollinated seeds of early maturing varieties were kindly supplied by Community Economic Development Project (CEDP). These were sown at the start of the rainy season, a month after the follow-up visit, and included maize, pumpkins, cowpeas, groundnuts, sunhemp and amaranth.



Mr Kiwit uses thorn branches to protect his crop field.



Deep ripping is tried on part of the communal crop field.



Rip lines on the communal crop field.



Newly constructed basins.



String is used to mark the basin rows.



Basins are dug by hoe or shovel.

INTERACTIONS RELATED TO CROPS

Radish bioassay of different soils, by farmer Hansina Hansen at Oupos, facilitated by Agricultural Extension student Obolokile Ratlale

Soil was collected during the first visit from eight different sites and placed in marked pots. Three radish seeds were sown per pot and later thinned to one plant per pot. The soil was kept moist and before the follow-up visit the thickness of the radishes was measured to indicate the overall fertility of the different soils. It is unclear what the differences between sites were, as the student's report was not retained.



One radish is left per pot, after thinning.



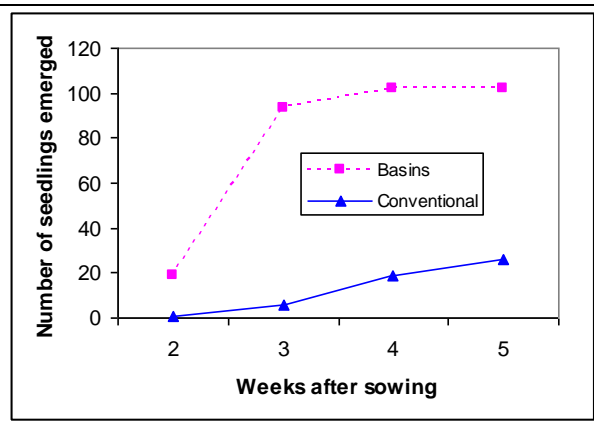
The chart shows the average radish thickness from the radishes grown in each of the eight different soils.

Basin tillage compared with conventional, by farmer Kiwit Kanab at Rooipos and Hendrik van Eden at Vaalpos, facilitated by Agroecology student Reinold Kharuxab

The conventional crop growing method of Vasdraai farmers is to use one's shoe or hand to scoop out a small hole into which two seeds of maize are dropped, covered with a little soil and pressed down with the shoe. This trial was done at Tjaka ADC to allow plots to be irrigated, since it took place in the middle of the dry season. On one plot of 10x10m a hoe was used to dig 80 basins of 35cm length x 15cm width x 15cm depth, into which 500ml of dry kraal manure was mixed, four seeds were sown and some pieces of dry weeds or crop residue were placed on top as mulch. Another 320 seeds were sown by the conventional method on another plot of 10x10m. A total of 14mm of irrigation was applied four times before the follow-up visit. Goats broke into the field and fed on the maize tops one week before the follow-up visit, but the difference between the two plots was still clearly visible. Four times more maize seedlings emerged on the basin plot ($P < 0.0001$ by Chi-test) and the maize plants were on average six times taller ($P < 0.0001$ by t-test) seven weeks after sowing.



Mr van Eden sows maize by the conventional method using his shoe.



Total maize seedlings that emerged in each 10x10m plot of each treatment.



Basin tilled plot 10 weeks after sowing...



..... compared with conventional plot.



Mr Kiwit digs basins in his field.

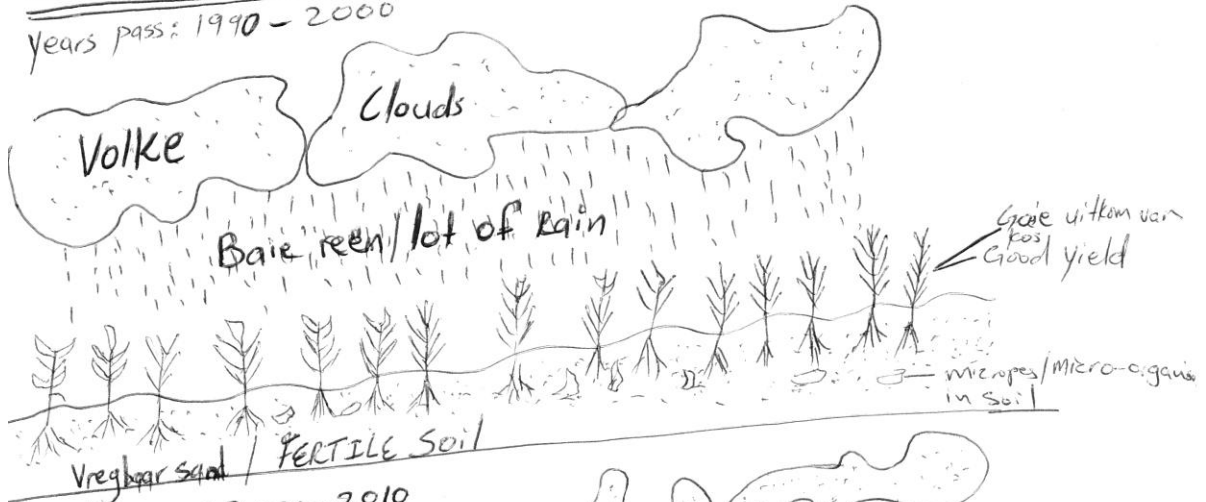


Training in basin tillage starts early.

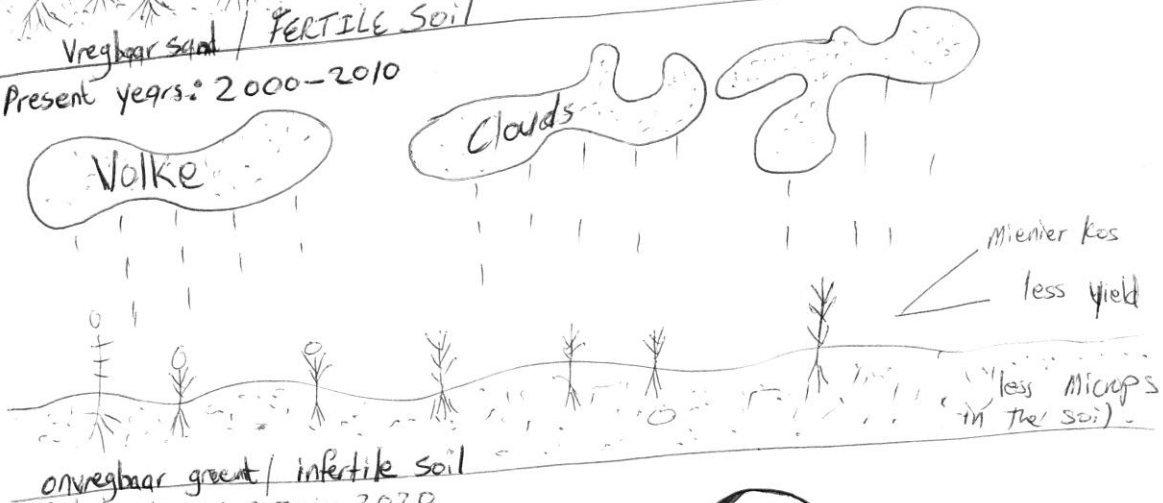
UPGRADED CROP TREND DIAGRAM

By: BASSIE

Years pass: 1990 - 2000



Present years: 2000 - 2010



Future years: 2010 - 2020

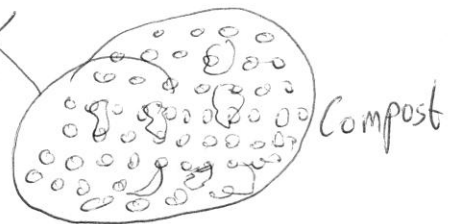


Practicing Crop Rotation

Onions			
Maize			

Diversification of Crops

Fertilize soil with compost



GARDENING

The poor water supply at Vasdraai has greatly limited vegetable gardening and hence not satisfied the nutritional needs of the community. This may now improve thanks to Komeho's facilitation that restored the water supply. The abundance of livestock supplies manure for gardens, but the plants need strong protection to keep out the hungry livestock. Insect pests are also a problem and most farmers respond by applying chemical pesticides. A focus on balancing the soil minerals would grow strong plants that do not attract insect pests and diseases. An analysis of the soil in the garden at the Tjaka ADC indicated a lack of Phosphorous and Sulphur.



Lucerne is protected with shade net from chickens and squirrels.



A scorched earth policy exposes garden areas to wind and heat from direct sun.



Goats destroyed this prickly pear.



Mint is protected with chicken wire



Unpalatable weeds are used as mulch.



Kraal manure is applied to a garden.

INTERACTIONS RELATED TO GARDENING

Vermiculture, by farmer Elias Afrikaner at Vaalpos, facilitated by Agricultural Extension student Samuel Ndjelekeni

During the first excursion, a plastic bath tub of 60 litres capacity was filled with a mixture of organic matter, including tree leaves, cow dung and hay, while some powdery calcrete was sprinkled in to supply the earthworms with calcium and to prevent the mixture from becoming too acidic. A litre of humus with surface feeding earthworms, *Eisenia fetida*, was added to the tub. The farmer was asked to moisten the bedding and add some vegetable peelings or fresh cow dung weekly.

During the follow-up visit, it was found that the mixture in the tub was very dry and most of the earthworms had either died or burrowed into the ground to seek moisture in the garden soil.



Earth worms are raised in this basin, which had holes pierced into the bottom.



A close up of an earthworm from the basin.

Chicken tractor, by farmer Eliazer April at #Ouxas, facilitated by Agroecology student Elize Eliphas

During the first excursion a floorless cage was constructed. Its dimensions were 1.45m length x 0.89m width x 1m height, and it had a roof of galvanised sheeting, walls of chicken wire and sticks inside for chickens to roost on. The cage was placed in a vegetable garden so that the chickens would scratch around in the soil, feeding on insect pests and seeds of weeds, while enriching the soil with their manure, thereby preparing the soil for growing vegetables in later. Six chickens were kept in this 'chicken tractor' and were provided with water and some food, as well as with fresh cow manure in which flies laid eggs so that the chickens could feed on the fly larvae a few days later, thus helping to control the fly population. The tractor was supposed to be moved from site to site, but by the time of the follow-up visit it was found at the same site, so the amount of manure was excessive for that site.

Radish seed was sown in plots with and without chicken manure. The density of radishes was higher in the manured plot, and the average thickness of the radishes from this plot was higher, but this difference was not significant ($P > 0.05$ by t-test).

The materials that had been ordered for the chicken tractor before the first visit had not been available on time. These were therefore brought along during the follow-up visit, so that a larger chicken tractor could be built.



The chicken tractor in the garden.



Manure remains after the chicken tractor is moved to another site in the garden.



Radishes are harvested.



The diameter of a radish is measured.

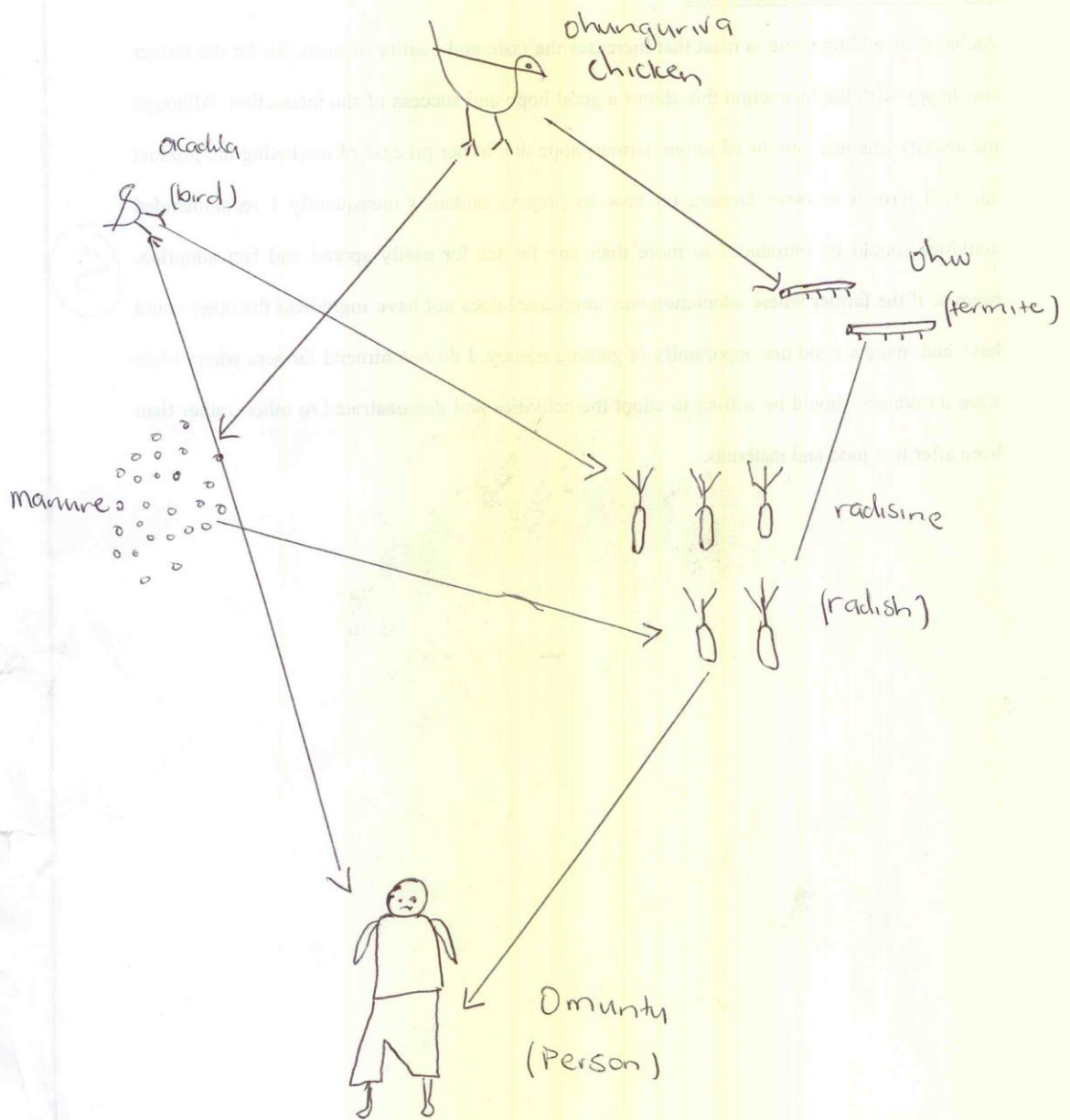


The radishes from the unmanured plot.



The radishes from the manured plot.

FOOD WEB CHAIN



By: Mr GERION PALCARAE
Complid: ELIZE ELIPHAS

Integrated fodder production, facilitated at Tjaka by Agricultural Extension students Lisbeth Kambonde and Sophia Amutenya (who failed to provide the farmer's name)

This interaction was done at Tjaka because during the first visit to Vasdraai there was insufficient water available at the gardens. During the first visit, rooted cuttings of Elephant grass (*Pennisetum purpureum*) were planted in a garden. During the second visit, seedlings of the Siratro (*Macroptilium atropurpureum*) legume were planted between the elephant grass plants after the Elephant grass leaves were harvested. Siratro is a leguminous creeper that fixes nitrogen and climbs up plants nearby. When grown together with Elephant grass on which it has climbed it contributes to the protein content of the two harvested together.



Elephant grass is planted during first visit in August.



At the follow-up visit in October the Elephant grass is growing well.



Twigs of Geelhout are placed as mulch between crops.



Twigs of Geelhout will conserve water, cool the soil and feed soil microbes.



Elephant grass is cut and will regrow very quickly.



Horses eagerly eat the cut Elephant grass.

Vine trellising, by farmer Mr Modise at Almapos, facilitated by Agricultural Extension student Julius Fink

An old vine trellis at Almapos was in need of repair. Creosote poles and droppers were used to strengthen the trellis and added many years to its life expectancy.



The vine trellis is in need of repair ...



... Even its poles are rotting.



A new pole is secured.



Many hands make light work!



The wire strainer is adjusted.



A stay wire is secured.

Bush and Tree - Trend - Diagramm

Editor: Family Bertha of Post Alma (Chret's Family)

past:



present:




future:



PRA Exercise of
 Julius N. Fink
 Agricultural Department
 Polytechnic of Namibia

house = houses



grass = grass



bush = bush



key: tree = tree



Molerat control, by farmer Cleophas at #Ouxas, facilitated by Agroecology student Joseph Mutero

Molerats are viewed by Vasdraai farmers as pests that destroy vegetables in gardens. Some commercial mole repellent was tried. Its active ingredient is garlic and it was poured into holes of molerats. No useful records were kept by the farmer, who claimed that the repellent had not been successful.

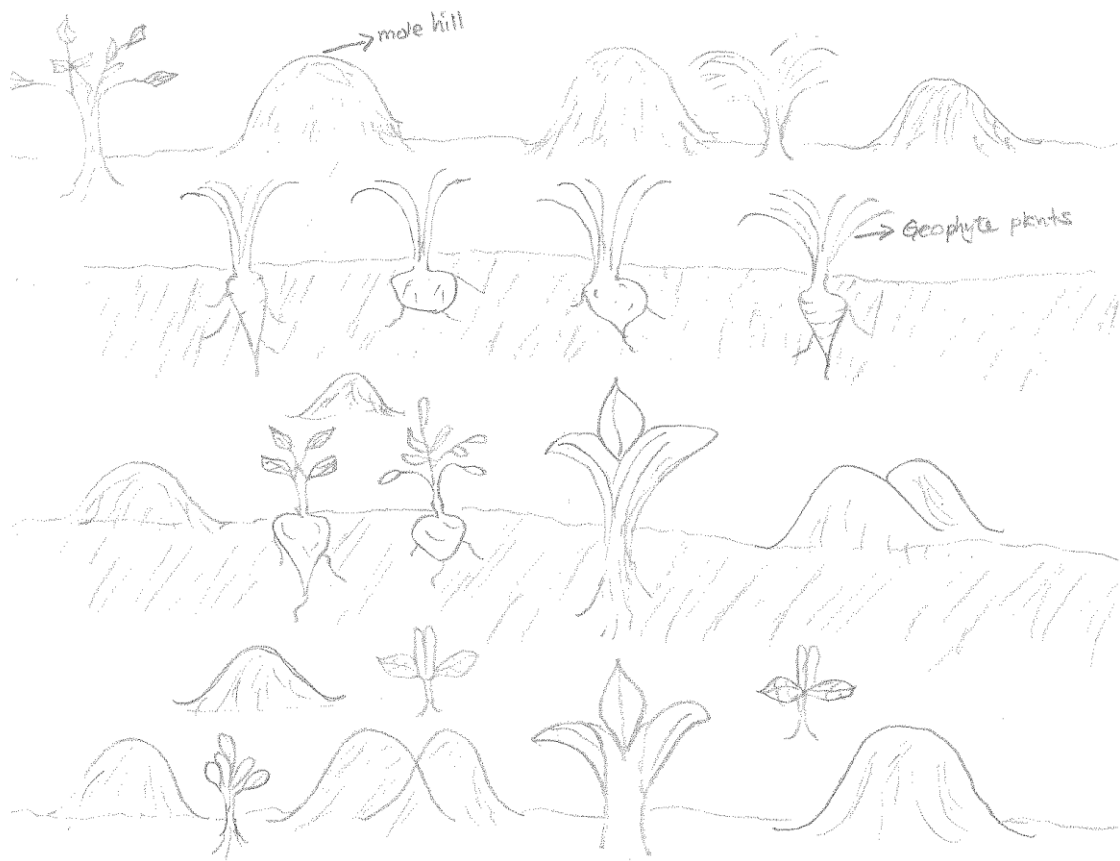
The student learnt from the experiences of Mr Modise who described the way he kills molerats. He digs a hole over a molerat tunnel, near its open end, and waits until a molerat appears at that position in the tunnel, whereupon he quickly pushes down a piece of corrugated iron with a sharp edge.



Molerat hills are abundant at Vasdraai.



Mole repellent is applied to the hole underneath a molerat hill in a garden.



ENERGY

Energy is an important resource, not only because non-renewable fossil fuels are becoming depleted at a very fast rate and need to be replaced with alternatives, but also because the burning of any fuel releases more carbon dioxide into the atmosphere and contributes to climate change. Firewood used to be plentiful at Vasdraai, but the situation is changing as the resource becomes depleted. Since most species of tree grow only very slowly at Vasdraai, it will take a very long time before new trees provide sufficient firewood. The wind blows often and sunshine is freely available at Vasdraai on most days, which both provide energy renewable.



The diesel engine that drives the pump at the Opstal borehole often breaks down and consumes a non-renewable resource.



The wind pump at Oupos is turned off because the pump is broken. If repaired and maintained regularly, it would provide clean, cheap renewable energy.



Donkeys are used for transport at Vasdraai. They are a potentially renewable resource, depending on the effect of donkey grazing on the rangeland. Currently they graze continuously, so threatening Vasdraai. If grazed areas are provided with long rest in the growing season, donkeys could be sustainable.



Hand-operated bellows are used to blow air onto the furnace used for blacksmithing.



A solar panel is used to charge a car battery that powers a radio and lights.



Heavy metals from old batteries strewn all over Vasdraai are likely to contaminate the ground water, if they have not already done so.

INTERACTIONS RELATED TO ENERGY

Cooking with a solar oven, by farmer Gertruide Eises at #Ouxas, facilitated by Agricultural Extension student Alex Shinana

The student was supposed to facilitate the farmer to make a solar oven, using cardboard, aluminium foil, glass wool insulation, glue, water-resistant paint and a sheet of perspex. Instead he took along the Polytechnic's sunstove and it was used to cook meat and potatoes. The sunstove had to be taken back to the Polytechnic.



A meal is cooked in a sunstove



A Tsotso stove saves firewood compared with an open fire.

Saving firewood with a Tsotso stove and insulation box, by farmer Daniel Urikhob at Groenpos, facilitated by Agricultural Extension student Liebhard Kamberipa

A Tsotso stove, made at the Tjaka ADC, was used for cooking. As soon as the food was boiling the pot was supposed to have been placed in an insulation box to continue cooking, to allow the fire to be extinguished so that the remaining wood could be kept for the next meal to be cooked. However, it appears as though this was not done. The stove was left with the farmer.

VALUE ADDING

Value added is the amount by which the value of goods is increased by each stage in its production. It is the difference between the value of all the inputs (raw materials) and the price at which the product is sold.

Value can be added to natural resources or agricultural produce by processing them into products that fetch higher prices, or by preventing damage to, or loss of, the harvested resources. Vegetables can be processed into products, such as chutneys, soup packets and pickles. These processed products not only have a longer shelf life, but can also be transported easier and cheaper, and sold for a better price than the fresh vegetables.

INTERACTIONS RELATED TO VALUE ADDING

Pickling of onions in EM, by farmer Johanna Pakarae at #Ouxas, facilitated by Agribusiness Management student Benita Elago

Onions were peeled underwater, to avoid eye irritation, and placed in clean glass jars up to the top. EM was poured into the jar to remove all air spaces. The lid was screwed on tightly and the jar was stored out of direct sunlight.

During the follow-up visit the jar was opened and the pickled onions were tasted.



A pickled onion is removed from the jar.



A sliced pickled onion looks delicious.

Chutney making, by farmer Francisca at Geelpos, facilitated by Agribusiness Management student Obolokile Ratlale

Onions were peeled and chopped together with tomatoes and apples. These were then put into a pan with water, vinegar, raisins, mustard, salt and pepper, and left to simmer gently for 90 minutes until the chutney was smooth and thick. It was then poured into warm, sterilized jars, covered and left to cool, and then sealed for storage to mature for three months.

Atchar making, by farmer Johanna Pakarae at #Ouxas, facilitated by Agribusiness Management student Elize Eliphias

Atchar was made from peeled and chopped carrots, onions, green peppers, green tomatoes, which were boiled for five minutes in a small amount of water with cooking oil. Chilli powder and barbeque spices were then mixed in.



Carrots are peeled, for making Atchar.



The Atchar is dished onto plates of food.

Craft making, by farmer Johanna Pakarae at #Ouxas, facilitated by Agribusiness Management student Mbava Solly

The student learnt how crafts are made from natural resources.



Crafts are displayed.



Bean sprouts are tasted.

Bean sprouting, by farmers Shepherd Swartz and Martha Geingos at Vaalpos, facilitated by Agribusiness Management student Samuel Ndjelekeni and Agricultural Extension student Abner Kashowa respectively

A handful of mung beans were soaked in water for 12 hours and then placed in a 10-litre plastic bucket with holes to drain away the water that was caught in another bucket below for watering plants in the garden. A moist cloth was placed on top of the beans. Water was added every 12 hours. After three days the bean sprouts were soft and ready to be eaten raw.

Jam making, by farmer Theresia Shoomena at Tjaka, facilitated by Agribusiness Management student Hileni Andreas

Jam was made from tomatoes, sugar and lemon juice, as indicated in the photos below.



Dried soup mix packets, by farmer Johanna Pakarae at #Ouxas, facilitated by Agribusiness Management student Virginia Radikara

Carrots and onions were peeled and the seeds were removed from tomatoes. These and spinach were chopped to medium fine size. All these chopped vegetables were placed in a saucepan with water and salt, then boiled for five minutes during which the mixture was turned with a wooden spoon for some seconds and left covered until cooked soft, to kill all cells. They were then poured into a strainer to drain, using a wooden spoon to press them to remove excess water. The boiled vegetables were then spread evenly on a tray that was kept in an open area to dry for three days, while occasionally turning them to avoid rotting of the lower parts that may otherwise stick to the tray. The dried vegetables were then stored in a container for later transfer to packets for selling.



Boiled chopped vegetables are spread on a tray for drying.



Cling wrap is wrapped around the decorated half-pumpkin.

Appeal adding to fresh produce, by Komeho technician Albert Kahiurika at Tjaka ADC, facilitated by Agribusiness Management student Hilya Hango

A pumpkin was slit in half and the seeds were removed. Pieces of broccoli, carrots and green and red peppers were placed in the middle of the pumpkin, to decorate it. Cling wrap was then wrapped around the decorated vegetables, to keep them in position, to keep out dust and to prevent fast drying. The student wanted to discard the pumpkin seeds, but it was pointed out that these are the most nutritious part of the pumpkin, being rich in oil. They can be dried or roasted before eating.

CONCLUSION

The visits to the Vasdraai were interesting and enjoyable. It is hoped that the farmers will continue to experiment on their own with new approaches to sustainable agriculture and value addition, through facilitation by Komeho. Some of the farmers took better care of their trials than others. However all of those who participated reported back on the trials with enthusiasm and confidence, so other community members who came to observe the report backs could learn from them.

The students learnt a lot about the complexities of community development in a resettlement farm. Joint management of resources requires consensus that will not please everybody. The chances of success are greater if options are thoroughly discussed and all members are aware of other people's opinions. Many members of the community are very keen to try out new ideas, so it is likely that appropriate options will eventually be found through experimentation. Ways can be found to farm more sustainably, to ensure long term success of the resettlement farm.

Suggestions for the community and Komeho include:

- That resting of rangeland be given priority attention to avoid desertification by wind-blown sand. The benefits of year-long resting followed by year-long grazing could be demonstrated in the benchmarks.
- That the depth of water be monitored in boreholes, to provide early warning of depletion of the limited groundwater.
- That preventative measures be taken to protect the quality of borehole water. Livestock should be kept away from boreholes and used batteries should be taken for safe disposal in towns. Methods of dry sanitation could be applied, instead of pit latrines that take faeces even closer to the ground water.
- That protection be provided to seedlings and saplings of valuable tree species, to allow them to replace trees that have been killed. This could be done by placing thorn branches around them for as many years as it takes for the trees to grow out of reach of livestock.
- That the opportunity of the basin tillage and deep ripping at the community field be used to experiment with different management inputs, to allow the Vasdraai farmers to determine which are most appropriate.
- That agroforestry be tried in the crop field, so that the soil and crops can benefit from the ecosystem functions performed by trees and farmers can benefit from the products of the trees.
- That environmentally friendly alternatives to poisons be used for pest and parasite control.
- That wind or solar power be used to pump water.



Thanks to all who contributed in any way to the wonderful learning experience!

