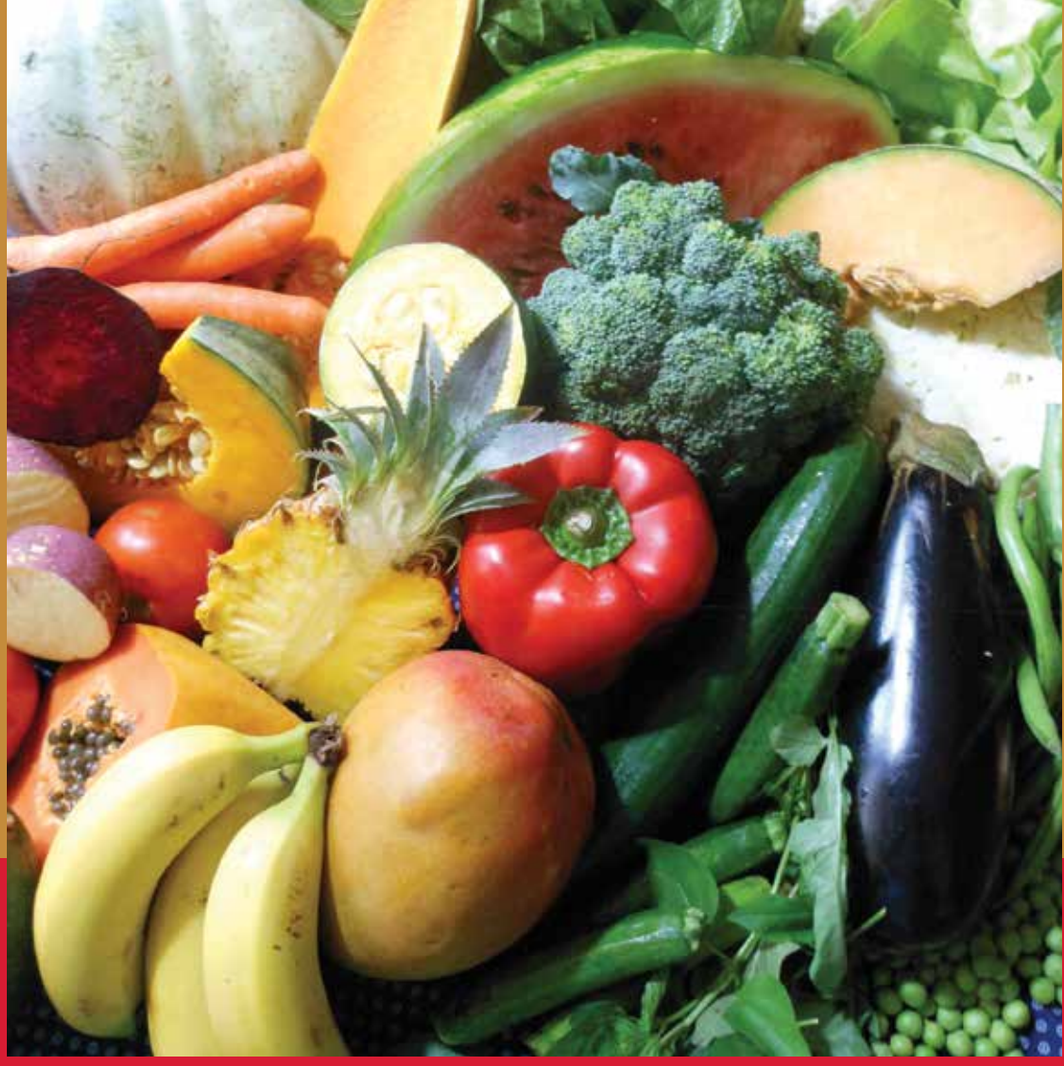

What can households grow and eat to improve nutrition in rural communities in South Africa?

Sheryl L Hendriks, Annemarie Viljoen, Diana Marais, Friede Wenhold, Angela M McIntyre, Mjabuliseni S Ngidi, Corné van der Merwe, John Annandale and Mmatlou Kalaba with Duncan Stewart[1]

Background

While there is not much evidence of wide-spread starvation and extreme under-nutrition in South Africa, national surveys provide evidence of multiple forms of deprivation related to the experience of hunger, wide-spread 'hidden hunger' or micronutrient deficiencies and increasing rates of over-weight and obesity. The co-existence of adult (especially female) overweight and obesity with hidden hunger and child stunting raises concern about household food security. This highlights the importance of understanding the constraints faced by households in achieving food security to ensure health, productivity and development.

The purpose of this project

This project set out to address a significant and longstanding gap in knowledge on where rural households obtain their food, their food consumption patterns and how crop production contributes to household food security. The purpose of the study was to identify a set of options for strengthening rain-fed and irrigated crop production in the rural areas that could lead to better nutrition.

Methodology applied

The unique study conducted by researchers at the University of Pretoria with funding from the Water Research Commission used a transdisciplinary research[1] approach to investigate the consumption and production patterns of rural households in four of the poorest areas in the Eastern Cape, KwaZulu-Natal, Limpopo and North West Province. The research sites were selected using existing data on poverty and child under-nutrition. Two sites from Ingquza Hill, Maruleng and Ratlou municipalities and one site from Jozini were randomly selected form a list of census enumeration areas. Available farm households from a list of Mjindi irrigation scheme members residing in Jozini comprised the second sample in this area.

Qualitative and quantitative data collection was carried out between October 2013 and November 2015 through focus group discussions, key informant interviews and a two-round panel survey to cover both the summer and winter seasons at each site. The food security situation of the households was assessed using anthropometry[2] of children between 24 and 59 months and their female caregivers, food consumption frequencies and the diversity of their diets.

The data was used to identify what crops could improve the dietary diversity and nutrition of the households. The agronomic conditions in the four sites were examined and crops that could grow in these areas were identified. The food consumption gaps and potential crops were prioritised in terms of which crops could be grown to improve the diets in each site. The prioritised list of crops were presented to the communities for validation through a workshop held at each site.

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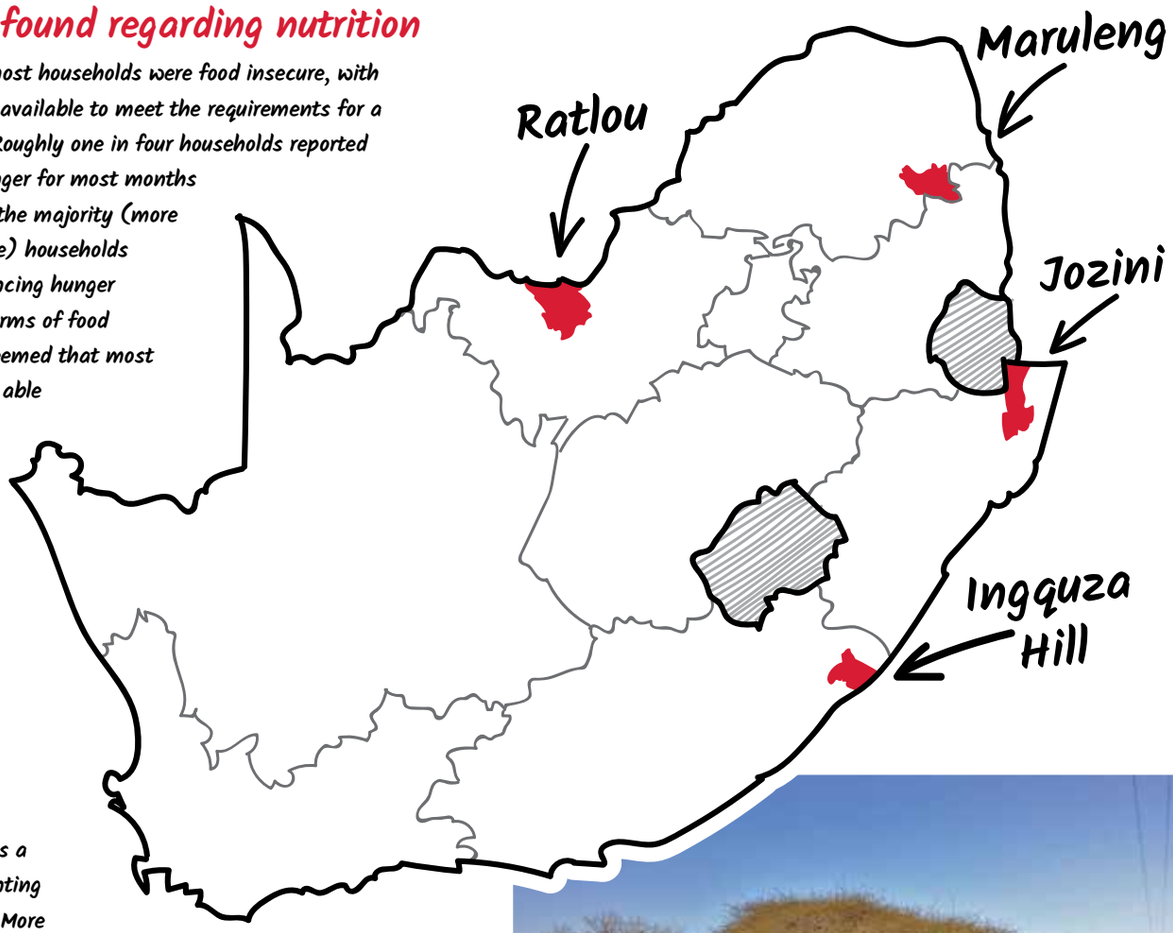
[1] © WRC and University of Pretoria, 2016. This research brief draws on a Water Research Commission (WRC) funded project K5/2172/4: Current rain-fed and irrigated production of food crops and its potential to meet all year round nutritional requirements of rural poor people in North West, Limpopo, KwaZulu-Natal and Eastern Cape Provinces. WRC and University of Pretoria, Pretoria. For more information, contact Prof Sheryl Hendriks (sheryl.hendriks@up.ac.za).

[2] An approach to research that seeks to address problems identified as complex through an active research programme that includes researchers from multiple disciplines working with communities.

[3] Measurement of height, weight and (for children) the mid-upper arm circumference.

What we found regarding nutrition

We found that most households were food insecure, with inadequate food available to meet the requirements for a diversified diet. Roughly one in four households reported experiencing hunger for most months of the year, but the majority (more than one in three) households reported experiencing hunger in January. In terms of food availability, it seemed that most households were able to purchase enough of the staple maize meal consumed by all households every day. A high proportion of female caregivers were over-weight and obese. There was a high level of stunting among children. More worrying was how many of these stunted children were also over-weight.



Adult BMI

Body Mass Index (BMI) N	Total sample 175	Number in 10
Underweight (BMI ≤ 18.5)	8.6	1
Normal (BMI 18.5 – 24.9)	32.6	3
Overweight (BMI 25 – 29.9)	22.3	2
Obese (BMI ≥ 30)	36.6	4
Total	100	
Over-weight and obese (BMI ≥ 25)	58.9	

These results indicate the presence of 'hidden hunger', which is characterised by inadequate dietary diversity and micronutrient deficiencies. Although we did not conduct clinical test to confirm this, the lack of dietary diversity and the daily consumption of foods from multiple food groups is indicative of an inadequate diet.

Child anthropometry

Sample	Categories	Z-scores Body Mass Index for age BAZ (%)	Number in 10 Body Mass Index for age BAZ (%)	Z-scores Height for age HAZ (%)	Number in 10 Height for age HAZ (%)	Z-scores Weight for age WHZ (%)	Number in 10 Weight for age WHZ (%)
Total	N	285	285	314	314	286	286
	Below the norm ≤ -2SD	5.3	1	23.9	2	4.5	1
	Normal (-1.99 SD ≤ z ≤+1.99 SD)	80.0	8	73.9	7	82.2	8
	Above the norm ≥+2SD)	14.7	1	2.2	1	13.3	1

Note: SD = standard deviations above or below the norm, BAZ = z score of Body Mass Index for age, HAZ = z score of height for age, MUACZ = z score for mid-upper arm circumference, WAZ = z score for weight for age and WHZ = z score for weight for height.

What we found regarding consumption

Access to a diversified diet was problematic for households in these communities. The typical diet consisted of maize meal with sugar. Where incomes permitted and production provided ingredients, a relish of onion and tomato or cabbage was added to one meal per day. Very few households consumed an adequate diversity of fruit and vegetables on a daily basis. Seasonality affected the availability of fresh fruit and vegetables, reducing availability of these foods in winter. A lack of water constrained production of many nutritious crops. Participants reported that drought and climate change have reduced opportunities for diversifying production and the availability of wild foods.

Dietary diversity scores from the 24-hour recall

Site	Season	N	Mean
Whole sample	☀	159	7.4
	❄	187	6.0
Ingquza Hill	☀	55	4.6
	❄	69	5.0
Jozini	☀	116	10.2
	❄	82	7.3
Maruleng	☀	36	4.1
	❄	56	4.8
Ratlou	☀	55	4.2
	❄	64	4.7
Non-cropping	☀	101	6.0
	❄	81	4.7
Cropping	☀	159	7.4
	❄	187	6.0
Irrigating	☀	95	8.9
	❄	105	7.2

What can households grow to improve their nutrition?

There is a dire need to strengthen existing good consumption patterns and promote and encourage the consumption of more diverse diets daily. Foods that were found by the study to be culturally acceptable and can grow in these communities included:

- Dark green leafy vegetables such as: Swiss chard, broccoli, the leaves of beetroot, cowpeas, beans, pumpkin and sweet potatoes and Africa leafy vegetables such as blackjack, cat's whiskers, amaranth, lamb quarters, nettle, nightshade, sow thistle etc.

- Other vegetables such as cabbage, cauliflower, cucumber, eggplant (brinjal), gem squash, "calabash" or other squash, green beans, green pepper, lettuce, peas, onion and zucchini (baby marrow)

- Orange-fleshed vegetables such as: beetroot, carrots, dark orange pumpkin, butternut or squash, orange-flesh sweet potato and tomato

- Legumes such as Bambara groundnut, cowpeas, dhal, dry beans and ground nut (peanut)

- Roots and tubers such as amadumbe, potato and sweet potato

- Orange-coloured fruit such as: citrus fruit, mango, papaya, pineapple, spanspek (cantaloupe) and watermelon or maketaan

- Other fruit including avocado, banana, figs, loquat and marula.

What are the benefits of crop production?

An encouraging number of households were engaged in agriculture in Ingquza Hill, Jozini and Maruleng. Many were keen to engage in agriculture and produce a wider range of crops. A very small number of households were engaged in agriculture in Ratlou due to the dryness of the area. Crop production improved dietary quality, increasing the availability of vegetables and in some cases fruit when in season. This improved household dietary diversity and children's nutritional outcomes. Income from farmland production and irrigated crop production increased intakes of vegetables and fruit in general but also meat, eggs, fish, milk, roots and tubers. Irrigation provided a more diverse diet – not only in terms of available fresh produce but possibly also through the sale of produce that enabled purchasing of foods that were not grown.

What constraints exist to producing crops to improve diets in these communities?

A number of fruit and vegetable crops can be produced in these communities. However, very few crops produce edible food in winter. In the areas with higher rainfall areas of Ingquza Hill, Jozini and Maruleng, some of the recommended crops can be produced under rain-fed conditions when normal climatic conditions prevail. Communities reported that this is not possible under the current conditions of drought. Most crops that will produce nutritious fresh vegetables in winter require irrigation. Access to irrigation is necessary to overcome these constraints, extend the range of crops possible, extend the growing season, reduce the risk of crop failure and improve yields.

Communities face different constraints where irrigation is concerned. In all the communities, there is potential to enhance household and smallholder irrigation. In some cases, this poses technical obstacles, for example in the arid Ratlou site. In others, it could be purely financial, for example in Maruleng, where a partly functioning irrigation system is in need of repair and maintenance in order to serve a wider community. More problematic is the scenario of Jozini, where the vast potential of the Mgindi irrigation scheme seems embroiled in conflicting commercial interests, managerial incompetence and stakeholder inequality. Ingquza Hill poses other challenges. Farming has undergone a drastic transformation from what was once highly productive, rain-fed terrace farming of staples and livestock to small, fenced, home gardens relying on rainfall or arduous manual irrigation. Significant investments in infrastructure might be necessary to make use of the relatively abundant river water in such hilly, rugged topography.

What support do households need?

There was widespread sentiment among small producers and home gardeners that agricultural inputs and extension services are inaccessible or simply inappropriate. In several communities, farmers spoke about the inappropriateness of trying to adapt the commercial crop inputs available through commercial channels to local conditions. Reports of indebtedness and crop failure were common. Smallholder producers in the study sites demonstrated the will and energy to adapt their methods to changing conditions, for example through the conservation of local and more drought-resistant crops. There is significant interest among farmers in knowledge sharing and farmer-to-farmer exchanges to this effect, and it would be timely to take an inventory of these practices and explore the potential for dissemination of these practices. Documentation of this knowledge and systems for sharing it are urgently needed to support production in these areas.

"Access to irrigation is necessary to overcome these constraints, extend the range of crops possible, extend the growing season, reduce the risk of crop failure and improve yields."

Conclusions

It is clear from the findings of this study that most households are food insecure, with inadequate food available to meet the requirements for a diversified diet. Most households were able to purchase enough of the staple maize meal consumed by all households every day. Relatively few young children and their female caregivers were under-weight but there was substantial evidence of extensive 'hidden hunger' in the forms of childhood stunting and childhood and adult overweight and obesity.

The study found an encouraging link between engagement in agriculture and improved dietary quality. Engagement in agriculture increased the availability of vegetables and in some cases fruit when in season. This improved household dietary diversity and children's anthropometry scores. Income from farmland production and irrigated agriculture led to increased intakes of vegetables and fruit in general but also meat, eggs, fish, milk, roots and tubers.

The study's findings can be generalised to poor rural communities in South Africa, showing that diets of rural poor households in South Africa lack diversity and do not include the frequent consumption of a diversity of fruit and vegetables necessary for ensuring good nutrition, human productivity and child development.

"The study found an encouraging link between engagement in agriculture and improved dietary quality."

Recommendations

1. Increased production of nutrient-dense crops of the recommended crops.
2. As many of the crops will require supplemental irrigation, water harvesting and irrigation systems are recommended to reduce drudgery, especially for women. The provision of boreholes and piped water are essential in drier areas such as Ratlou although production in such areas will always require extensive amounts of supplemental irrigation.
3. Research is urgently needed to investigate the impact of climate change on growing patterns to advise on adaptations to production techniques, irrigation practices, production timing and the potential for the development of early- and late-maturing crops to extend the growing season and make food available for longer periods.
4. Biofortification of crops is needed to increase the nutrient density of multiple micronutrients, especially in dual crops such as beetroot or where the nutrient water productivity of more than one nutrient could be enhanced (such as vitamin A, iron and zinc in carrots). Dual crops are crops where more than one part of the plant is nutrient-dense such as the leaves, roots, fruit or seeds.

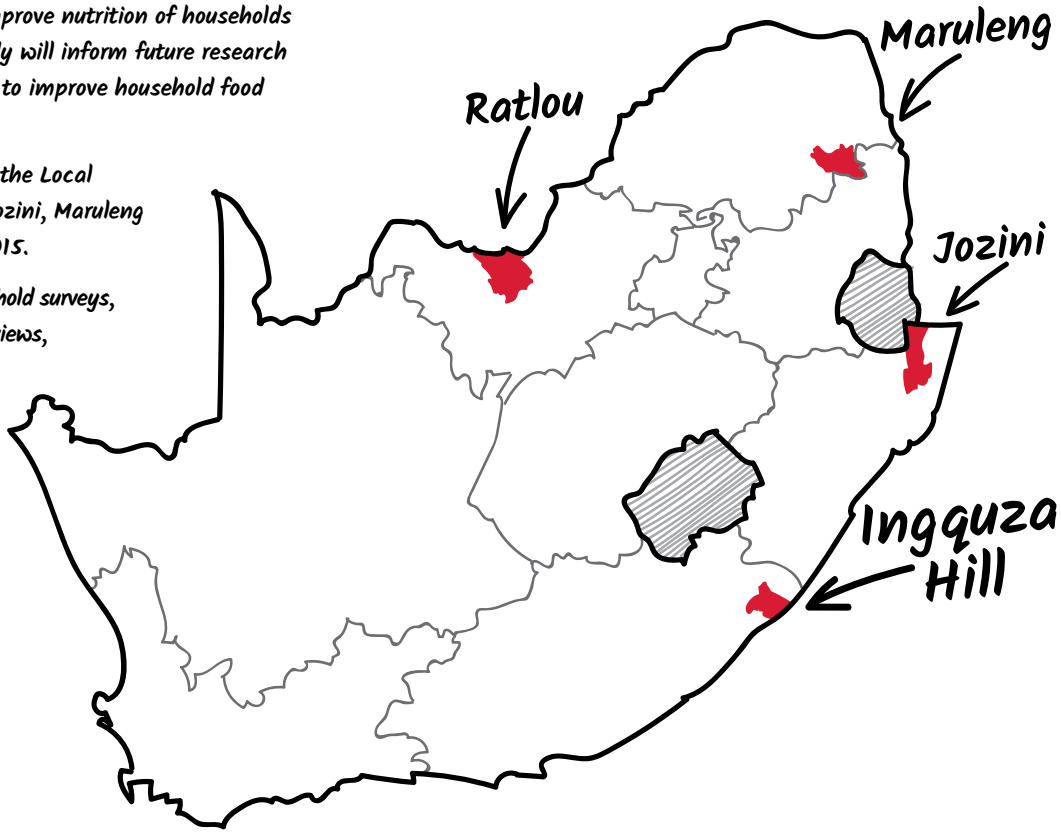
What should rural households grow and eat to improve their nutrition?

Over the past three years, the University of Pretoria has been conducting a research project commissioned by the Water Research Commission of South Africa.

The study set out to understand what people in rural households in South Africa grow and eat in order to make recommendations to WRC and the Department for Agriculture, Forestry and Fisheries to plan further research into how rain-fed and irrigated crop production can improve nutrition of households in these communities. This study will inform future research studies on water efficient crops to improve household food security and nutrition.

The research was carried out in the Local Municipalities of Ingquza Hill, Jozini, Maruleng and Ratlou between 2013 and 2015.

The survey team conducted household surveys, focus group discussions and interviews, in both summer and winter. The findings and recommendations were validated through workshops with members of the communities. This brochure presents the key findings and recommendations of the study.



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For more information, please contact Prof Sheryl Hendriks at sheryl.hendriks@up.ac.za.

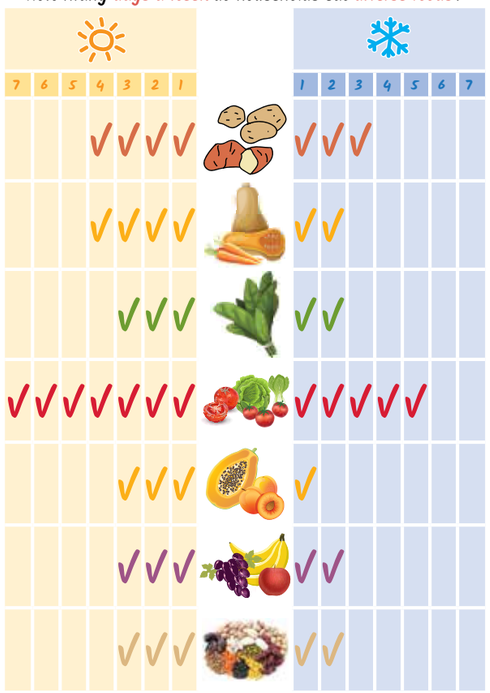
Ingquza Hill

What we've found...

Our research shows that 9 out of 10 households in Ingquza Hill grow crops on open plots or in household, community or school gardens. Half of these were irrigated.

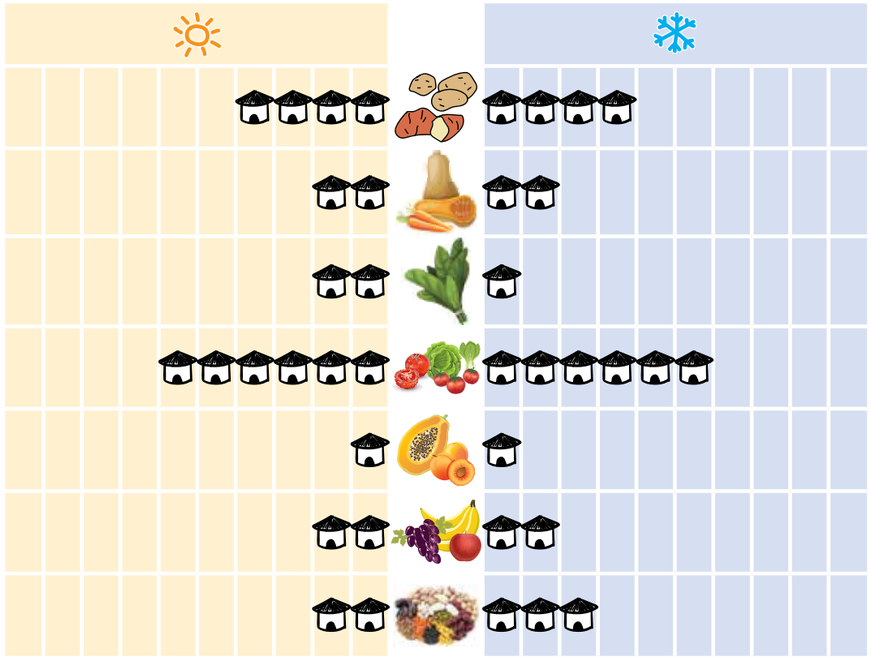
We found that all households ate purchased maize every day. Very few households eat diverse diets or eat foods from the following food groups every day.

How many days a week do households eat diverse foods?



Most households in Ingquza Hill ate foods from 5 food groups each week. It is recommended that people eat foods from as many groups as possible everyday to ensure good nutrition. The results show that diets in this community are not very diverse.

How many households eat diverse foods?



Key messages...

We weighed and measured female care-givers and children between 24 and 59 months of age at each household.

We found that six out of 10 women are overweight.

One out of 10 children in Ingquza Hill are under-weight for their age.

Two out of 10 children were short for their age.

This shows these children have been under-nourished.

Two out of 10 children are overweight for their age.

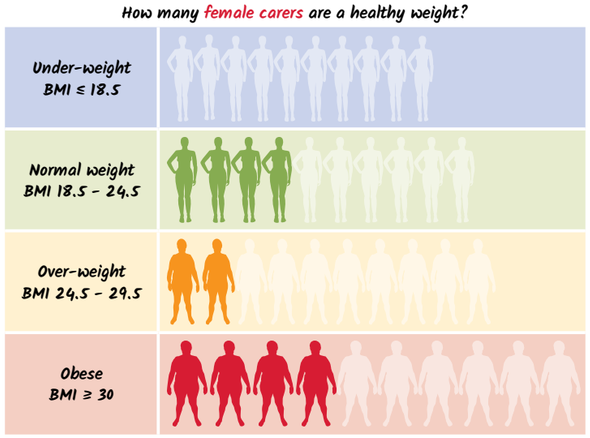
This shows that these children are not eating balanced and healthy diets.

We found that households that grow crops eat fresh vegetables and fruits more often than those who do not grow crops. They also eat more eggs and fish than households that do not grow crops.

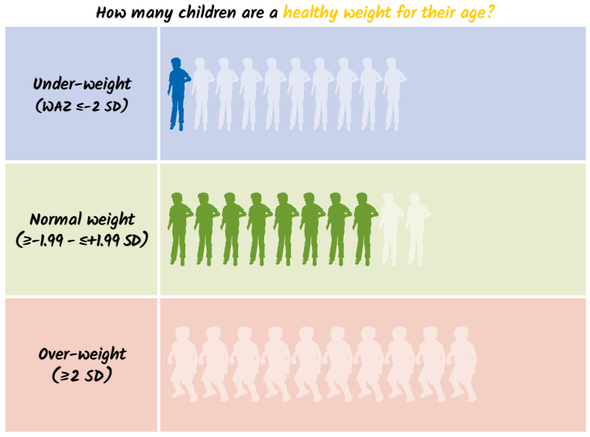
We also found that households that irrigate enjoy a more diverse diet, eating fresh vegetables and fruits more often than those who do not irrigate their crops. They also eat more meat, eggs, fish and dairy products than households that do not grow crops or irrigate.

Improvements in the diets of all household members is necessary for improved nutrition, health and productivity.

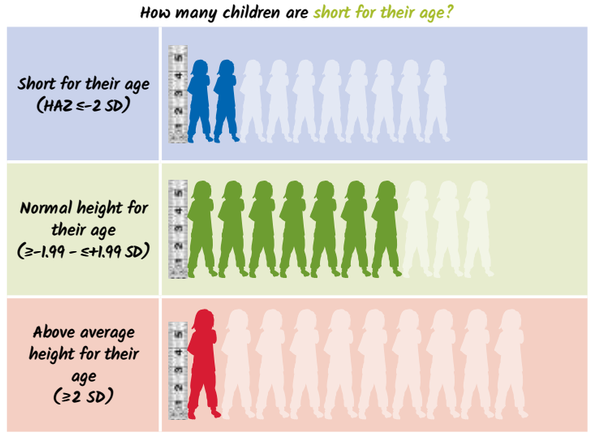
How many female carers are a healthy weight?



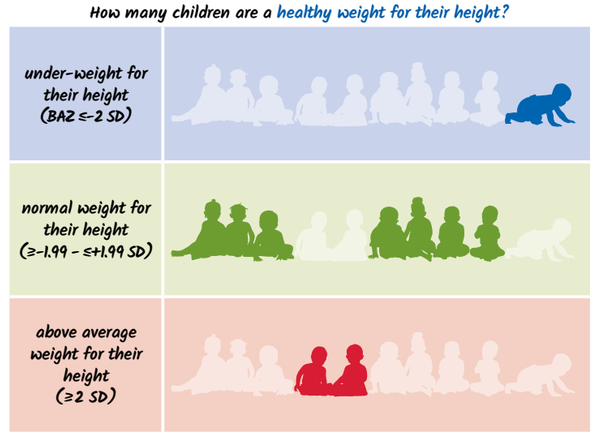
How many children are a healthy weight for their age?



How many children are short for their age?



How many children are a healthy weight for their height?



BMI = Body Mass Index (calculated as your height in metres squared, divided by your weight in kg), WAZ = weight-for-age z-score, HAZ = height-for-age z-score, BAZ = BMI-for-age z-score.

What we recommend...

Eating a variety of vegetables and fruits regularly ensures the intake of a variety of nutrients required for maintaining health bodies and minds. Diversified diets help children grow and develop optimally.

Diets can be improved by including the following foods or increasing the number of times in a week these foods are consumed. Growing these foods for home consumption will improve the diets of small children and adults.

The crops in the table below are able to grow in Ingquza Hill.

Food group	Crop	Can provide food:	Supplemental irrigation needed
White roots and tubers	Amadumbe	☀	
	Potato	☀ ❄	💧
	Sweet potato	☀	
Orange-flesh vegetables	Beetroot	☀ ❄	💧
	Tomato	☀	
	Carrots	☀ ❄	
	Pumpkin/ Butternut	☀	
	Gem squash	☀	
	Orange-fleshed sweet potato	☀	
	Hubbard squash	☀	
	Pumpkin	☀	
Dark green leafy vegetables	Broccoli	☀ ❄	💧
	African leafy vegetables	☀ ❄	
	Swiss Chard	☀ ❄	
	Beetroot leaves	☀ ❄	💧
	Pumpkin leaves	☀	
	Cowpea and legume leaves	☀	

☀ = Can provide food in summer

❄ = Can provide food in winter

💧 = Supplemental irrigation needed

Food group	Crop	Can provide food:	Supplemental irrigation needed
Other vegetables	Cauliflower	☀ ❄	
	Cabbage	☀ ❄	
	Lettuce	☀ ❄	💧
	Cucumber	☀	
	Eggplant	☀	
	Green beans	☀	
	Green pepper	☀	
	Peas	☀ ❄	💧
	Zucchini	☀	
	Onion	☀ ❄	
Orange-coloured fruit	Mango	☀	
	Papaya	☀	
	Spanspek	☀	
	Watermellon	☀	
Other fruit	Avocado	☀	
	Banana	☀	
	Figs	☀	
	Loquat	☀	
	Pineapple	☀	
Legumes	Bambara groundnut	☀ and when dried all year	
	Cow peas	☀ and when dried all year	
	Broadbeans	☀ and when dried all year	
	Harricot beans	☀ and when dried all year	
	Sugar Beans	☀ and when dried all year	
	Groundnut	☀ and when dried all year	

The research team thanks the the community for their participation in this project and the team of fieldworkers for their hard work in collecting the data.

LIMA Rural Development Foundation and staff are thanked for facilitation of the fieldwork and most appreciated.

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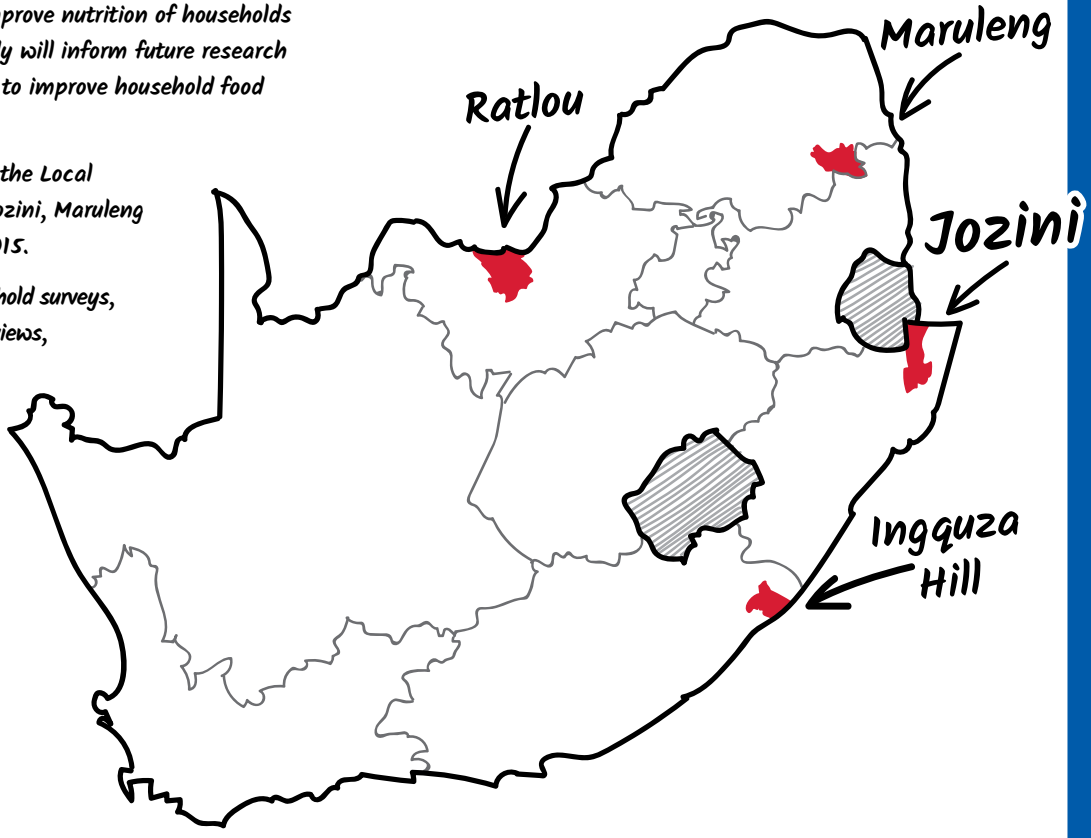

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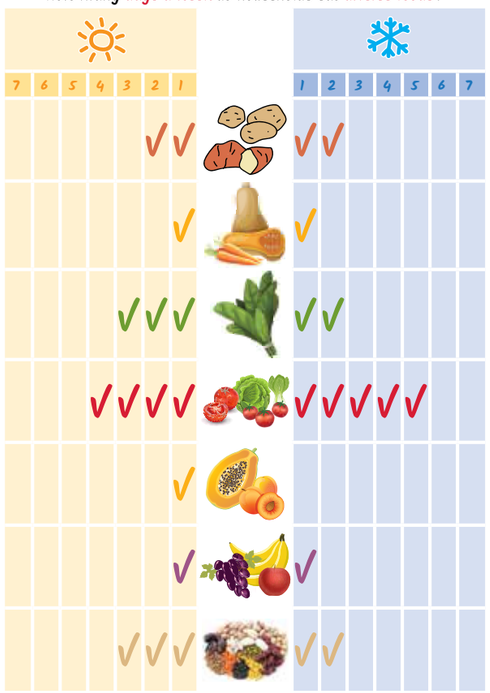

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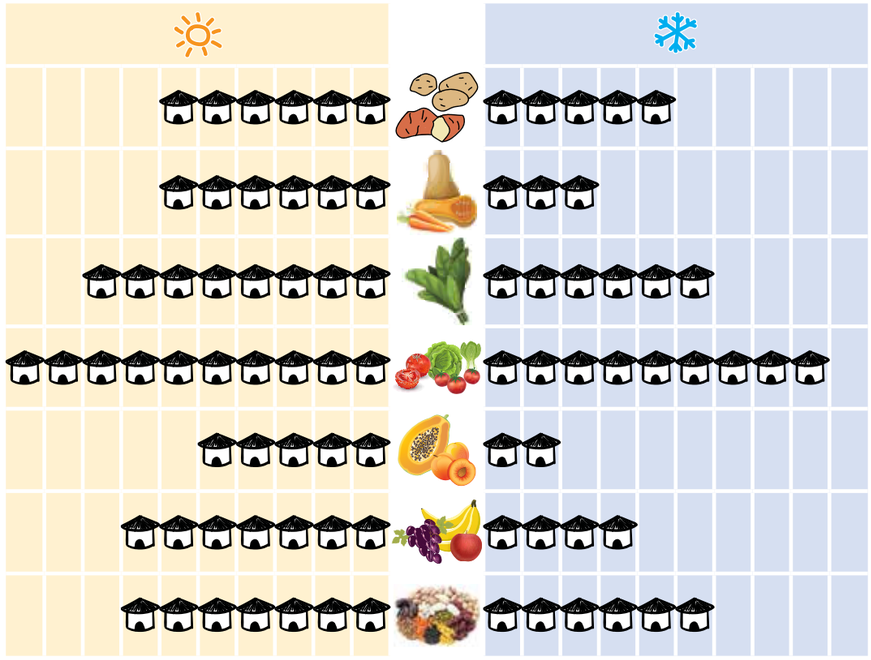

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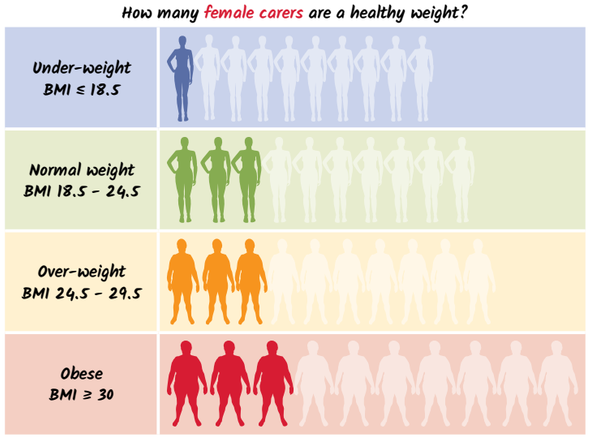
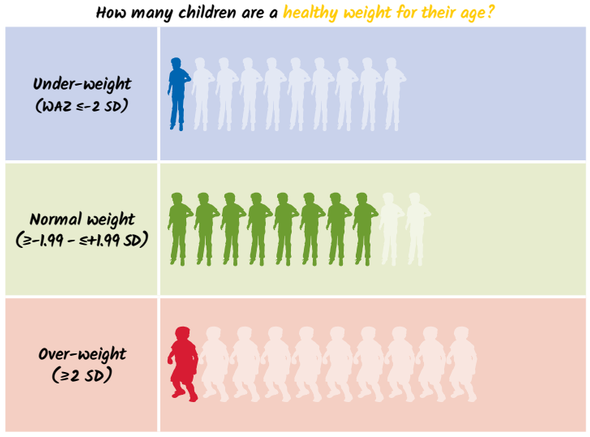
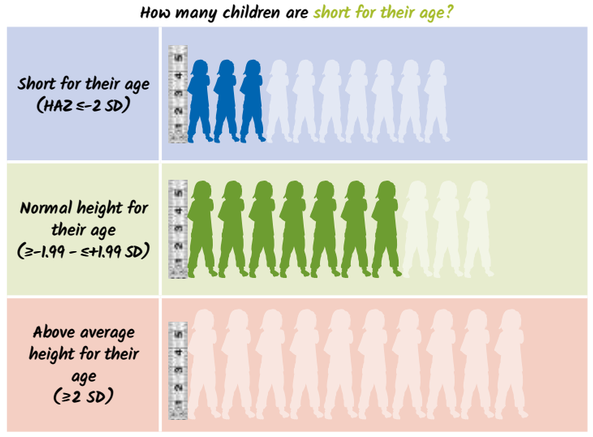


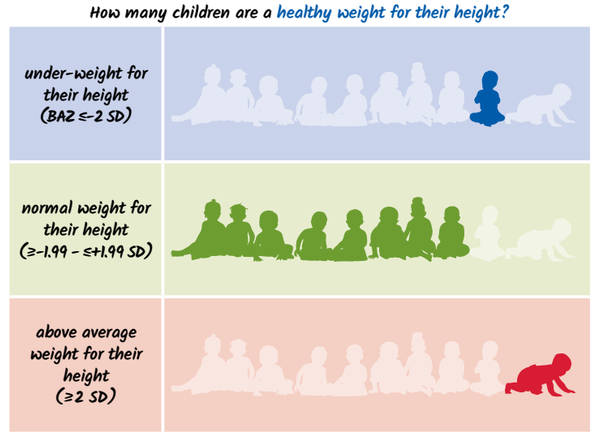
How many children are a healthy weight for their age?



How many children are short for their age?



How many children are a healthy weight for their height?



BMI = Body Mass Index (calculated as your height in metres squared, divided by your weight in kg), WAZ = weight-for-age z-score, HAZ = height-for-age z-score, BAZ = BMI-for-age z-score.

What we recommend...

Eating a variety of vegetables and fruits regularly ensures the intake of a variety of nutrients required for maintaining health bodies and minds. Diversified diets help children grow and develop optimally.

Diets can be improved by including the following foods or increasing the number of times in a week these foods are consumed. Growing these foods for home consumption will improve the diets of small children and adults.

The crops in the table below are able to grow in Jozini.

Food group	Crop	Can provide food:	Supplemental irrigation needed
White roots and tubers	Amadumbe	☀	
	Potato	☀ ❄	💧
	Sweet potato	☀	
Orange-flesh vegetables	Beetroot	☀ ❄	💧
	Tomato	☀	
	Carrots	☀ ❄	
	Pumpkin/ Butternut	☀	
	Gem squash	☀	
	Orange-fleshed sweet potato	☀	
	Hubbard squash	☀	
	Pumpkin	☀	
Dark green leafy vegetables	Broccoli	☀ ❄	💧
	African leafy vegetables	☀ ❄	
	Swiss Chard	☀ ❄	
	Beetroot leaves	☀ ❄	💧
	Pumpkin leaves	☀	
	Cowpea and legume leaves	☀	

☀ = Can provide food in summer

❄ = Can provide food in winter

💧 = Supplemental irrigation needed

Food group	Crop	Can provide food:	Supplemental irrigation needed
Other vegetables	Cauliflower	☀ ❄	💧
	Cabbage	☀ ❄	
	Lettuce	☀ ❄	💧
	Cucumber	☀	
	Eggplant	☀	
	Green beans	☀	
	Green pepper	☀	
	Peas	☀ ❄	💧
	Zucchini	☀	
	Onion	☀ ❄	
Orange-coloured fruit	Mango	☀	
	Papaya	☀	
	Spanspek	☀	
	Watermellon	☀	
Other fruit	Avocado	☀	
	Banana	☀	
	Figs	☀	
	Loquat	☀	
	Pineapple	☀	
Legumes	Bambara groundnut	☀ and when dried all year	
	Cow peas	☀ and when dried all year	
	Broadbeans	☀ and when dried all year	
	Harricot beans	☀ and when dried all year	
	Sugar Beans	☀ and when dried all year	
	Groundnut	☀ and when dried all year	

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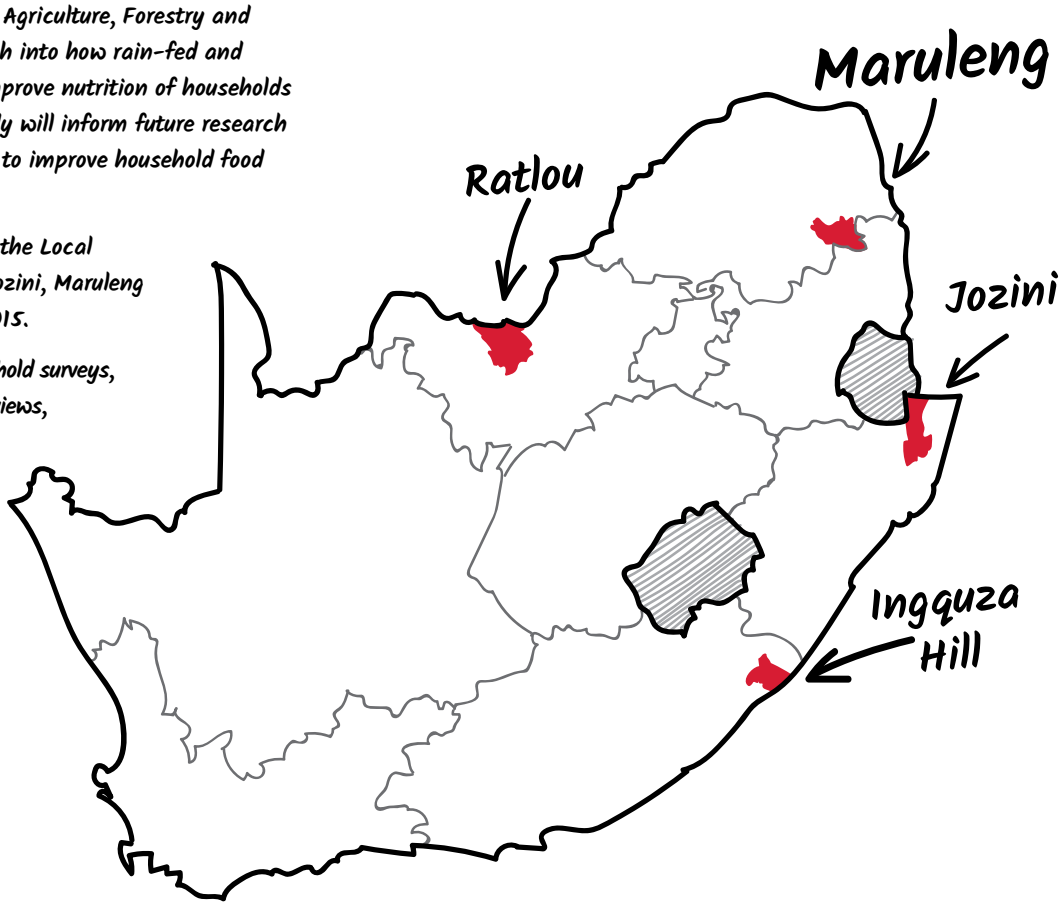
The study set out to understand what people in rural households in South Africa grow and eat in order to make recommendations to WRC and the Department for Agriculture, Forestry and Fisheries to plan further research into how rain-fed and irrigated crop production can improve nutrition of households in these communities. This study will inform future research studies on water efficient crops to improve household food security and nutrition.

The research was carried out in the Local Municipalities of Ingquza Hill, Jozini, Maruleng and Ratlou between 2013 and 2015.

The survey team conducted household surveys, focus group discussions and interviews, in both summer and winter. The findings and recommendations were validated through workshops with members of the communities. This brochure presents the key findings and recommendations of the study.



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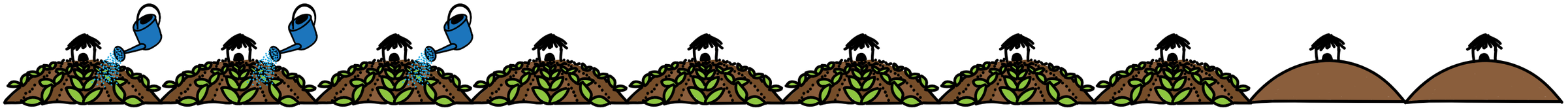
For more information, please contact Prof Sheryl Hendriks at sheryl.hendriks@up.ac.za.

Maruleng

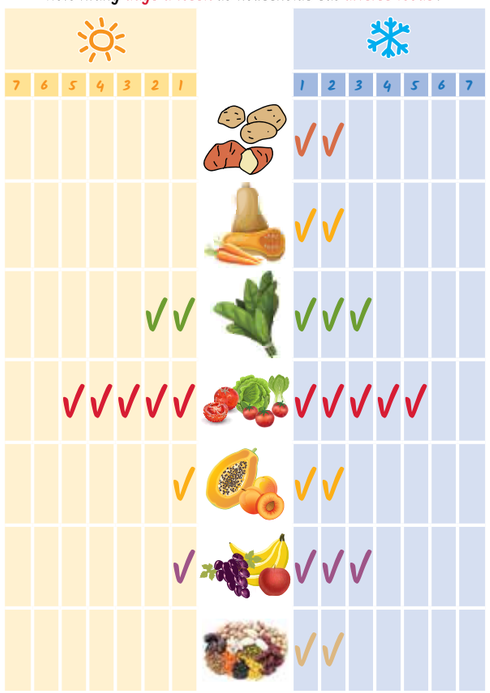
What we've found...



Our research shows that 8 out of 10 households in Maruleng grow crops on open plots or in household, community or school gardens, 3 of these were irrigated.

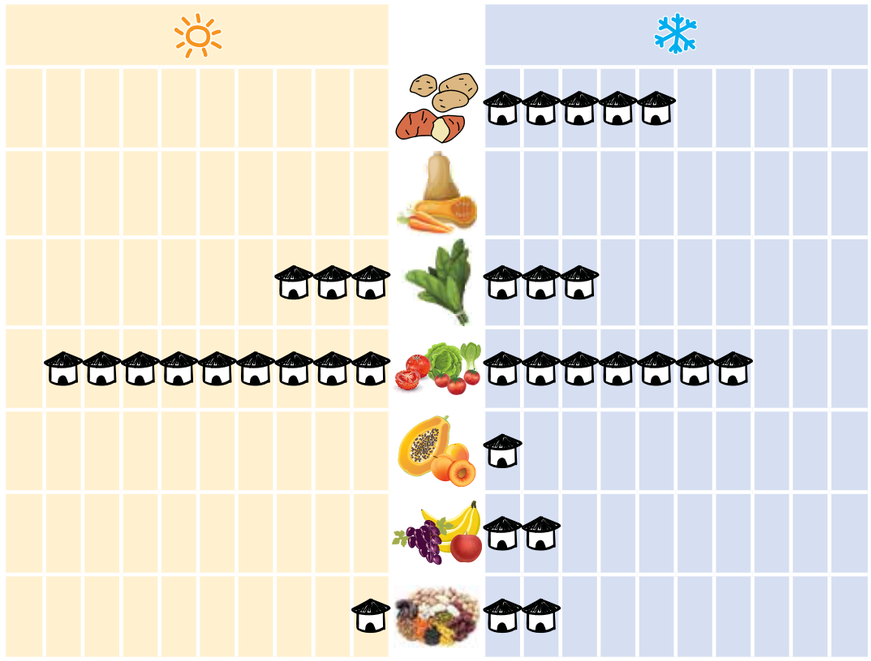
We found that all households ate purchased maize every day. Very few households eat diverse diets or eat foods from the following food groups every day.

How many days a week do households eat diverse foods?



Most households in Maruleng ate foods from 5 food groups each week. It is recommended that people eat foods from as many groups as possible everyday to ensure good nutrition. The results show that diets in this community are not very diverse.

How many households eat diverse foods?



Key messages...

We weighed and measured female care-givers and children between 24 and 59 months of age at each household.

We found that six out of 10 women are overweight.

One out of 10 children in Maruleng are overweight for their age.

Two out of 10 children were short for their age.

This shows these children have been under-nourished.

Two out of 10 children are overweight for their age.

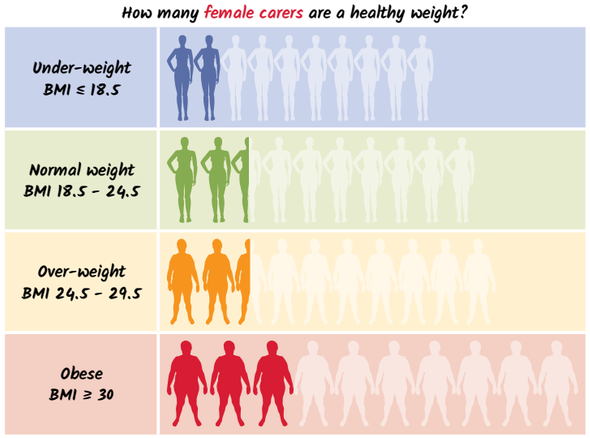
This shows that these children are not eating balanced and healthy diets.

We found that households that grow crops eat fresh vegetables and fruits more often than those who do not grow crops. They also eat more eggs and fish than households that do not grow crops.

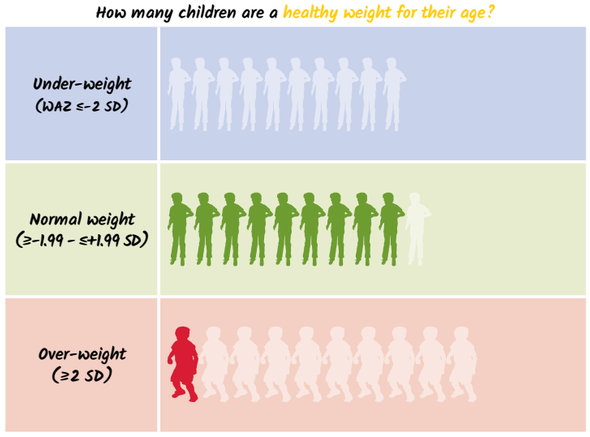
We also found that households that irrigate enjoy a more diverse diet, eating fresh vegetables and fruits more often than those who do not irrigate their crops. They also eat more meat, eggs, fish and dairy products than households that do not grow crops or irrigate.

Improvements in the diets of all household members is necessary for improved nutrition, health and productivity.

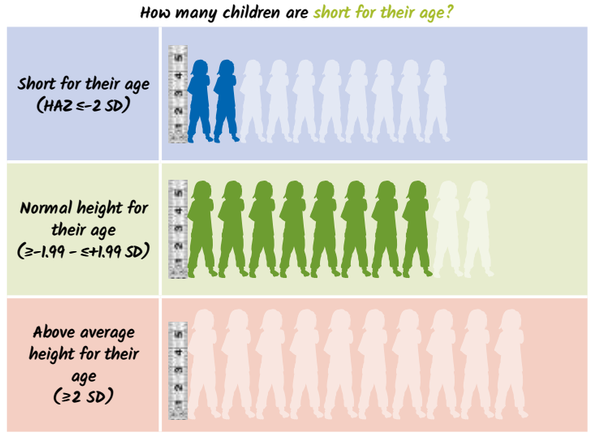
How many female carers are a healthy weight?



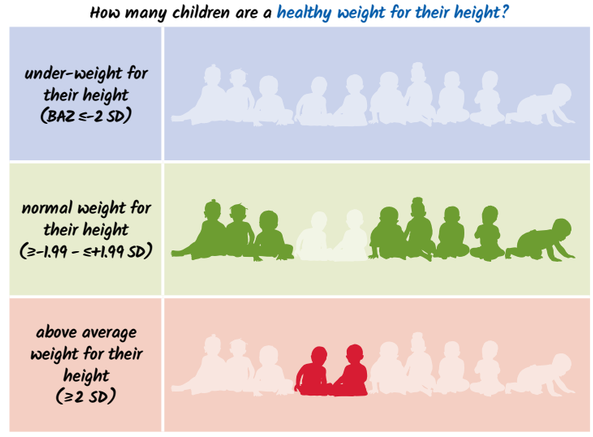
How many children are a healthy weight for their age?



How many children are short for their age?



How many children are a healthy weight for their height?



BMI = Body Mass Index (calculated as your height in metres squared, divided by your weight in kg), WAZ = weight-for-age z-score, HAZ = height-for-age z-score, BAZ = BMI-for-age z-score.

What we recommend...

Eating a variety of vegetables and fruits regularly ensures the intake of a variety of nutrients required for maintaining health bodies and minds. Diversified diets help children grow and develop optimally.

Diets can be improved by including the following foods or increasing the number of times in a week these foods are consumed. Growing these foods for home consumption will improve the diets of small children and adults.

The crops in the table below are able to grow in Maruleng.

Food group	Crop	Can provide food:	Supplemental irrigation needed
White roots and tubers	Amadumbe	☀	
	Potato	☀ ❄	💧
	Sweet potato	☀	
Orange-flesh vegetables	Beetroot	☀ ❄	💧
	Tomato	☀	
	Carrots	☀ ❄	💧
	Pumpkin/ Butternut	☀	
	Gem squash	☀	
	Orange-fleshed sweet potato	☀	
	Hubbard squash	☀	
	Pumpkin	☀	
Dark green leafy vegetables	Broccoli	☀ ❄	💧
	African leafy vegetables	☀ ❄	
	Swiss Chard	☀ ❄	
	Beetroot leaves	☀ ❄	💧
	Pumpkin leaves	☀	
	Cowpea and legume leaves	☀	

☀ = Can provide food in summer

❄ = Can provide food in winter

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Food group	Crop	Can provide food:	Supplemental irrigation needed
Other vegetables	Cauliflower	☀ ❄	💧
	Cabbage	☀ ❄	💧
	Lettuce	☀ ❄	💧
	Cucumber	☀	
	Eggplant	☀	
	Green beans	☀	💧
	Green pepper	☀	
	Peas	☀ ❄	💧
	Zucchini	☀	
	Onion	☀ ❄	
Orange-coloured fruit	Mango	☀	
	Papaya	☀	
	Spanspek	☀	
	Watermellon	☀	
Other fruit	Avocado	☀	
	Banana	☀	
	Figs	☀	
	Loquat	☀	
	Pineapple	☀	
Legumes	Bambara groundnut	☀ and when dried all year	
	Cow peas	☀ and when dried all year	
	Broadbeans	☀ and when dried all year	
	Harricot beans	☀ and when dried all year	
	Sugar Beans	☀ and when dried all year	
	Groundnut	☀ and when dried all year	

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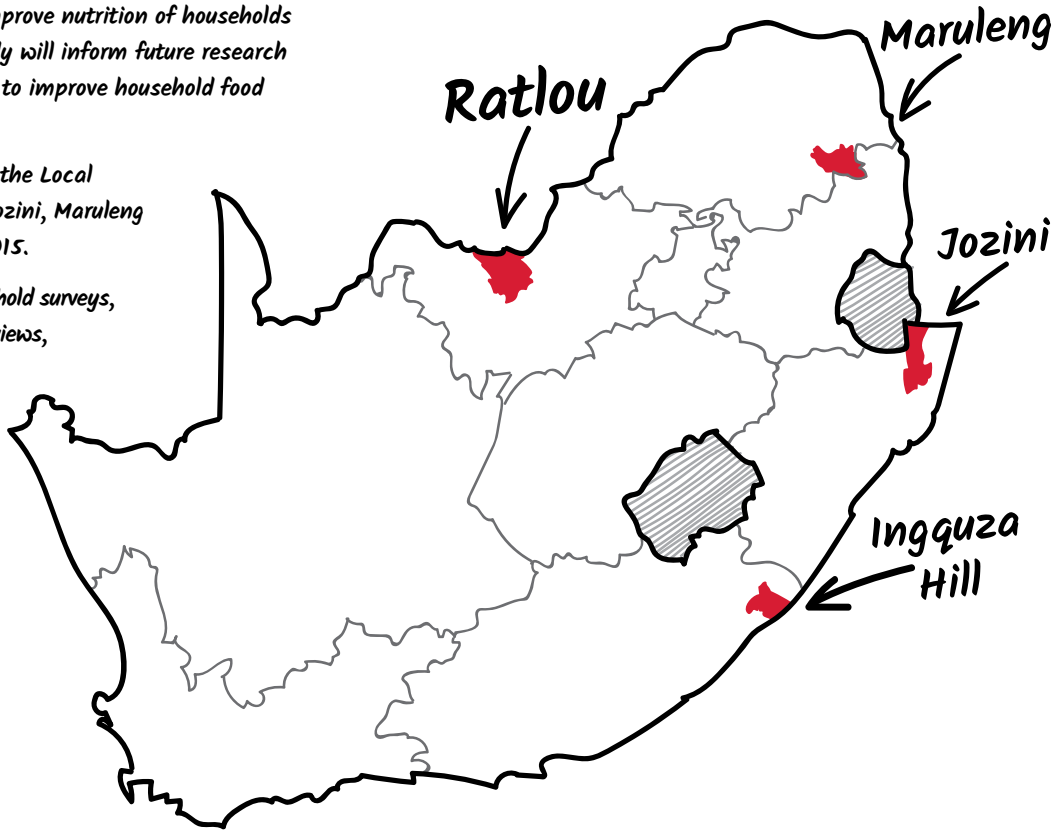

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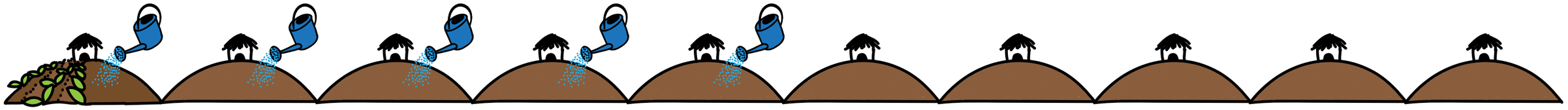
For more information, please contact Prof Sheryl Hendriks at sheryl.hendriks@up.ac.za.

Ratlou

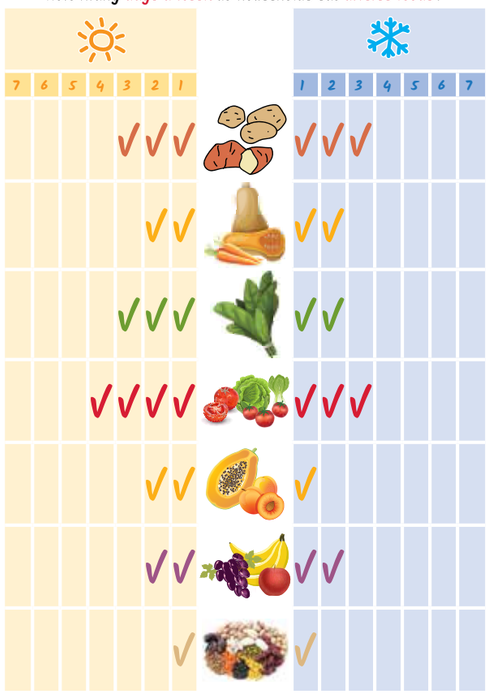
What we've found...



Our research shows that very few households in Ratlou grow crops on open plots or in household, community or school gardens. Those who do grow, irrigate.

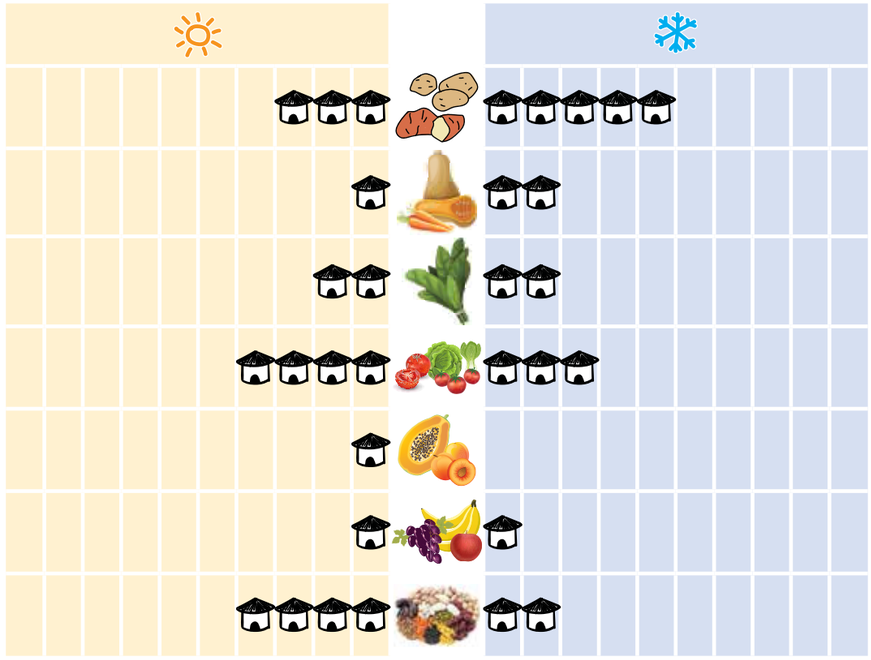
We found that all households ate purchased maize every day. Very few households eat diverse diets or eat foods from the following food groups every day.

How many days a week do households eat diverse foods?



Most households in Ratlou ate foods from 5 food groups each week. It is recommended that people eat foods from as many groups as possible everyday to ensure good nutrition. The results show that diets in this community are not very diverse.

How many households eat diverse foods?



Key messages...

We weighed and measured female care-givers and children between 24 and 59 months of age at each household.

We found that six out of 10 women are overweight.

One out of 10 children in Ratlou are under-weight for their age.

Three out of 10 children were short for their age.

This shows these children have been under-nourished.

Two out of 10 children are overweight for their age.

This shows that these children are not eating balanced and healthy diets.

We found that households that grow crops eat fresh vegetables and fruits more often than those who do not grow crops. They also eat more eggs and fish than households that do not grow crops.

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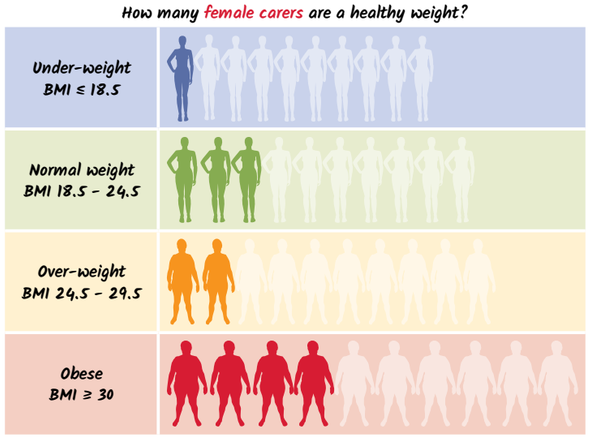
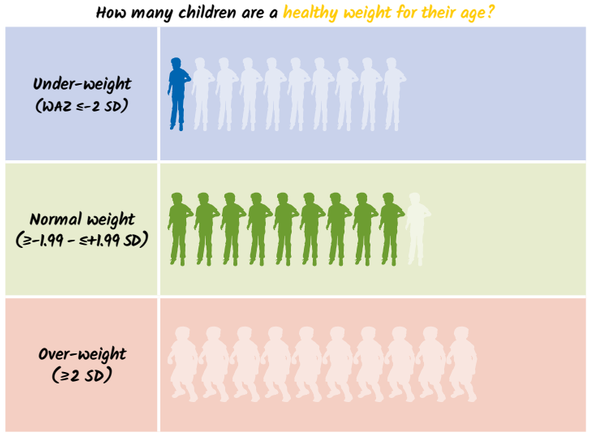
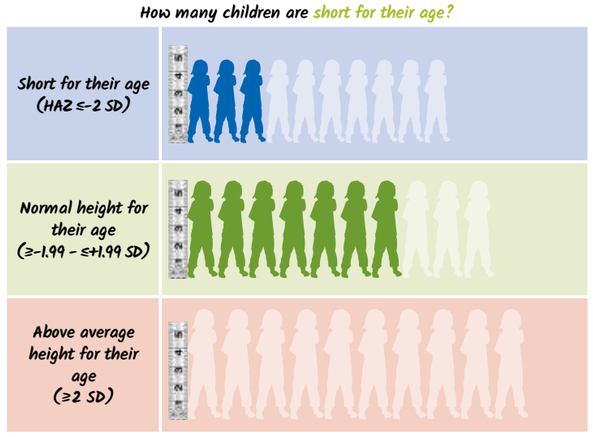


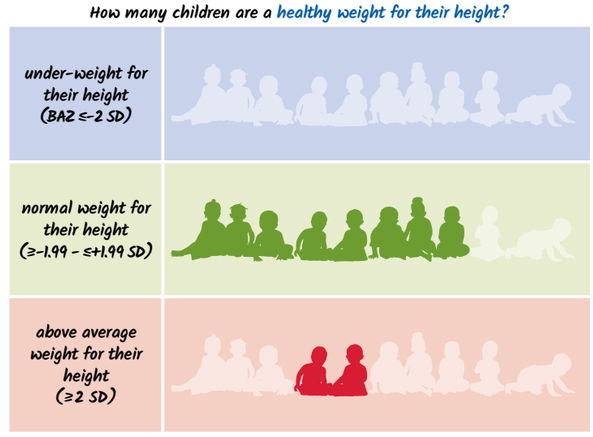
How many children are a healthy weight for their age?



How many children are short for their age?



How many children are a healthy weight for their height?



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Food group	Crop	Can provide food:	Supplemental irrigation needed
White roots and tubers	Amadumbe	☀	
	Potato	☀ ❄	🚿
	Sweet potato	☀	
Orange-flesh vegetables	Beetroot	☀ ❄	🚿
	Tomato	☀	
	Carrots	☀ ❄	
	Pumpkin/ Butternut	☀	
	Gem squash	☀	
	Orange-fleshed sweet potato	☀	
	Hubbard squash	☀	
	Pumpkin	☀	
Dark green leafy vegetables	Broccoli	☀ ❄	🚿
	African leafy vegetables	☀ ❄	
	Swiss Chard	☀ ❄	
	Beetroot leaves	☀ ❄	🚿
	Pumpkin leaves	☀	
	Cowpea and legume leaves	☀	

Food group	Crop	Can provide food:	Supplemental irrigation needed
Other vegetables	Cauliflower	☀ ❄	🚿
	Cabbage	☀ ❄	🚿
	Lettuce	☀ ❄	🚿
	Cucumber	☀	
	Eggplant	☀	
	Green beans	☀	🚿
	Green pepper	☀	
	Peas	☀ ❄	🚿
	Zucchini	☀	
	Onion	☀ ❄	
Orange-coloured fruit	Mango	☀	
	Spanspek	☀	
	Watermellon	☀	
	Orange/citrus	❄	
Other fruit	Avocado	☀	
	Figs	☀	
	Loquat	☀	
Legumes	Bambara groundnut	☀ and when dried all year	
	Cow peas	☀ and when dried all year	
	Broadbeans	☀ and when dried all year	
	Harricot beans	☀ and when dried all year	
	Sugar Beans	☀ and when dried all year	
	Groundnut	☀ and when dried all year	

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