

**SWAZILAND SUGAR ASSOCIATION
TECHNICAL SERVICES DEPARTMENT
DROUGHT MANAGEMENT GUIDELINES-2016/17**

Preamble

In light of the prevailing drought conditions the Technical Services department of SSA has put together management practices growers and all other industry stakeholders can adopt during this time and going forward.

Content	Page
1.0 Managing cane during drought period.	1
2.0 Water management and Prevention of Stool die back during drought period	6
3.0 Status of Highveld seedcane scheme during the drought period	11

1.0 Managing cane during drought period.

1.1 New Developments/ Establishments

New developments/establishments and (horizontal) expansion programmes should be put on hold for the time being until the situation normalizes. Purchasing of expensive capital items will have to be kept at minimum as well.

1.2 Replanting

With more planting area being carried forward, seedcane is expected to be in short supply once the situation improves. Hence sources should be secured early and only certified seed be used. For next year's planting programme, nurseries should be properly prepared for planting to ensure an adequate supply of healthy seedcane of the right varieties.

It is very likely that above average replanting will occur during the next two years due to drought affected ratoons. It is therefore very important to plan and secure seedcane requirements accordingly, ensuring only good quality and certified material is used.

Where there are notable stool failures in plant and younger ratoons, gap-filling (gaps of one metre or more) need to be considered using only certified seedcane. In older ratoons, it is preferable to slash or spray patchy weed infested sections and replant the whole field after the next harvest. Growers are encouraged to put together a sound short to medium term replant programme to ameliorate the backlog that has been created by the drought. In fallowed lands, where possible, growers should consider green manuring or planting cover crops.

1.3 Varieties

Different varieties are known to respond differently to drought effect. Unfortunately there is no formal study or breeding programme that has been put in place to select varieties that are drought tolerant. However, variety N41 has been noted to have some tolerance to drought compared to most industry varieties, followed by N36 (SASRI trials). Mauritian variety M1176/77 is also described as a drought tolerant variety, and this is evident from its performance in SSATS trials. Varieties N25, N19 and NCo376 have been identified to be less tolerant to drought.

There is a need to test and index all industry sugarcane varieties according to their drought tolerance. With the recurring drought scourge, there is a need to source sugarcane varieties that are both high yielding and drought tolerant as well.

1.4 Chemical ripening

Growers should plan for the possible use of ripeners, where conditions permit. Where the cane is lush, soils have a high total available water (TAW) factor and there is little chance of stress before harvest, a cost effective response to ripeners is possible. Fusilade Forte (or generics) responds best after 6 - 8 weeks from application and Ethrel after 10-12 weeks. Growers should note that drought stress in crops begins much earlier than the visible symptoms. Hence, growers are encouraged to continue scheduling irrigation accordingly. The soil water balance should inform if the crop has plunged into water deficit. Growers are advised not to spray stressed cane as this will result in deleterious effect not only on the current crop but on the succeeding ratoons as well. Only cane with eight or more green leaves and long upper internodes, and with sufficient soil moisture to maintain vigorous growth for three to four weeks after spraying should be considered for chemical ripening.

1.5 Crop Nutrition

Crop yields are expected to decline this year hence not all the fertilizer applied will be used up the current crop. Consequently, nitrogen (N) applications may be reduced by 20 kg N/ha on the next crop as this will be compensated by residual N. It is strongly

recommended that soil samples be tested for this residual N. Phosphorus (P) and potassium (K) also can be reduced proportionally depending on the forecasted yield. Leaf sampling and analyses are strongly recommended once full growth resumes, and six weeks had elapsed after the last fertilizer application.

Growers should ensure that the crop should be adequately supplied with P and K (as well as all the other important elements) as the plant use these elements to produce a healthy root system which confer drought tolerance. To benefit from the optimum cane conditions (February – March), growers should ensure that all late harvested fields have received the balance of their N where split application is practiced when substantial rains are received. Under these conditions, split application of N is strongly recommended. Where there is no irrigation water, fertilizer application should be stalled until sufficient rains are received or irrigation water is restored.

1.6 Pests and Diseases

With the drought effect, smut and eldana levels are expected to increase. Hence growers are encouraged intensify field surveys and roguing. SSATS can assist in training growers P&D teams on this regard. Fields to be ploughed-out should be tested for RSD. Where tests are positive, a six months fallow period is necessary. Growers are encouraged to register all abandoned fields with SSATS.

1.7 Weed control

An effective weed control programme is essential as it will reduce moisture loss in the soil. Growers are encouraged to apply long term pre or early post emergent herbicides before the appearance of weeds.

Many fields, especially where the cane was slow to canopy, might have developed weed problems in recent weeks, with *Cynodon* in particular being common. A below canopy application of glyphosate (or similar scorch chemicals) will effectively knock down existing growth and recovery would be suppressed by the cane canopy. Please ensure that plant-chemical contact is avoided since the extreme temperatures make the plants to be hyper sensitive to herbicides, and recovery from herbicide scorching is prolonged (if it eventually occurs).

1.8 Harvesting

All stressed but millable cane should be harvested this year. Unmillable cane should not be cut back at this stage, unless it is heavily infested with eldana. Cutting back will stimulate the crop to break dormancy and re-grow, and, if soil moisture is not sufficient, stool mortality will occur. Early harvest of stressed cane is important if more than half the stalks have less than three green leaves, especially when recovery is limited and yield decline is severe. Once sufficient rains are received, stressed cane with three green leaves or less, which is too short to mill, should be slashed back to rejuvenate new growth.

In this difficult period, growers are encouraged to increase the area under green cane harvesting. There is overwhelming evidence from literature that nothing conserves moisture better than a trash blanket. Where cane is burnt, the cane tops must be spread evenly over the field to give as much ground cover as possible. It should be noted that not only does a good trash blanket conserve moisture in the soil, it is also an effective way of suppressing weeds thereby saving on weeding costs, and further prevents soil erosion.

Infield controlled traffic is very essential in such times. Compaction from heavy infield machinery restricts the rooting depth of the soil, thereby limiting the amount of soil water available to the cane plant.

1.9 Maintenance

High potential fields should not be sacrificed for low potential fields. Marginal areas should receive low priority and could be abandoned if the threat of drought continues.

With the surrounding uncultivated or bushy areas being so dry this time around, and some fields being abandoned, the risks of runaway fires are high, hence growers are encouraged to ensure that fire breaks are adequate and firefighting equipment is in order.

Figure 1 below is a decision tree of handling drought affected cane (sourced from SASRI's information sheet 4.5).

HANDLING DROUGHTED CANE

With rainfall in some areas being lower than normal, growers may be looking for some advice on managing cane affected by drought. The decision tree below offers some guidance. For more on this subject, please consult Information Sheet 4.5 *Management of Cane Affected by Drought*.

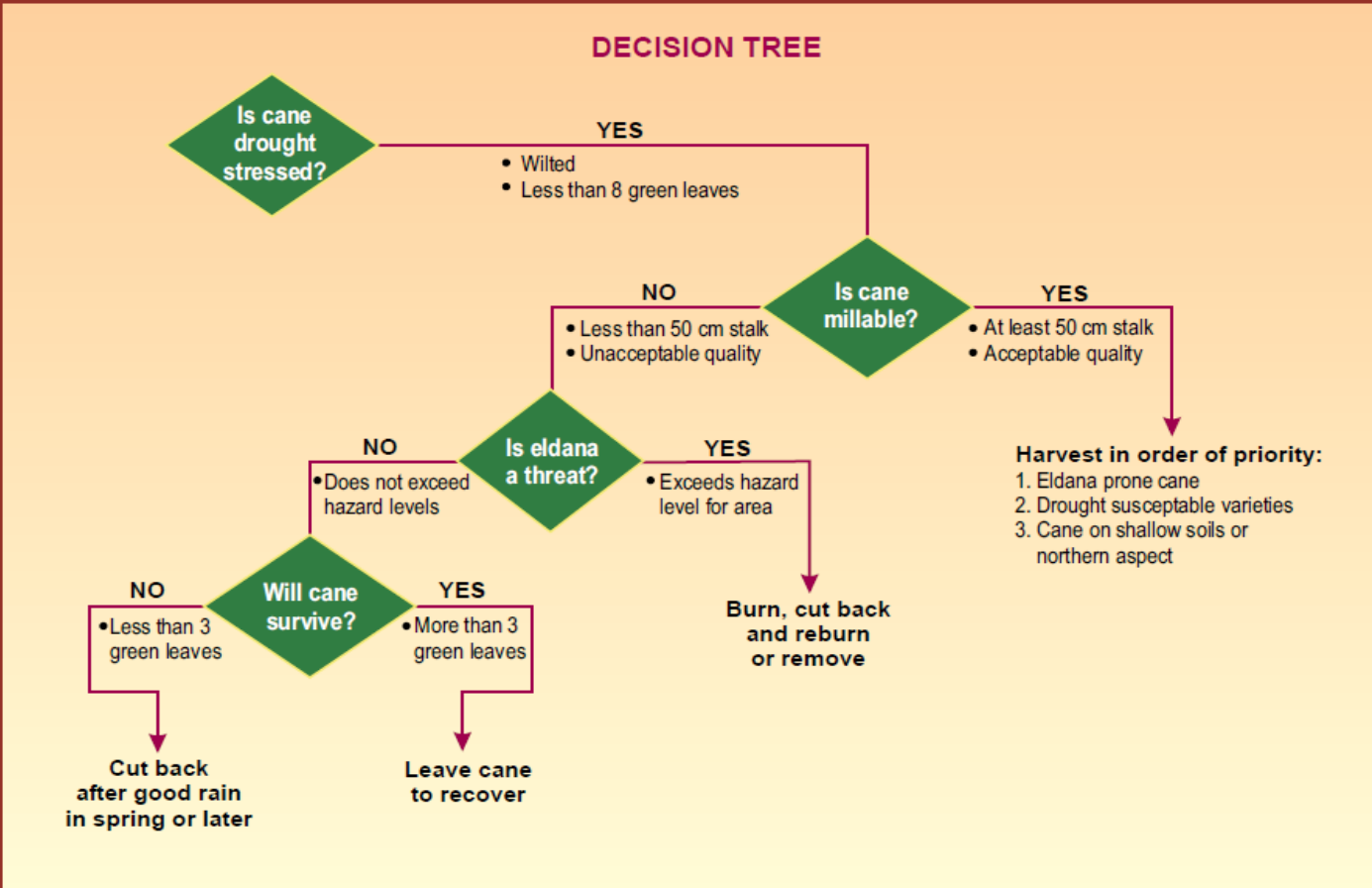


Figure 1: Decision tree for managing drought affected cane (source: SASRI, Information Sheet 4.5)

2.0 Water management & Prevention of Stool die back during drought period

2.1 Crop Water Management

Some studies indicate that die back of the sugarcane stool may begin when irrigation falls below 22% of crop water requirement for a long period. Under severe stress, the photosynthetic apparatus of the sugarcane plant shuts down and the plant starts to wilt. Other studies indicate that the effects of drought interact with other factors in the plant, soil and atmosphere continuum to cause the death of sugarcane plants.

Growers have been advised previously to irrigate according to the strategy shown in **Table 1**. However, a water saving strategy was agreed as shown in **Table 2**. The current drought has necessitated a more stringent water saving strategy to spread the available water and minimize death of the cane. This strategy is shown in **Table 3**.

Table 3 is based on the proposition that a 25% crop water requirement is applied to prevent die back of cane stools.

Table 1: Normal Winter Irrigation Strategy

Harvest month	Month of year									Total
	April	May	June	July	Aug	Sep	Oct	Nov	Dec	
April	2	1	1	1	2	2	2	2	2	15
May		2	1	1	1	2	2	2	2	13
June			2	1	1	1	2	2	2	11
July				2	1	1	2	2	2	10
August					2	1	2	2	2	9
September						2	1	2	2	7
October							2	1	2	5

Table 2: Water-Saving Winter Strategy

Harvest month	Month of year									Total
	April	May	June	July	Aug	Sep	Oct	Nov	Dec	
April	1	1			1	1	1	2	2	9
May		1	1			1	1	2	2	8

June			1	1			1	2	2	7
July				1	1		1	2	2	7
August					1	1	1	2	2	7
September						1	1	1	2	5
October							1	1	1	3

Table 3: Cane Survival Strategy (25% of Crop Water Requirement)

Harvest month	Month of year									Total
	April	May	June	July	Aug	Sep	Oct	Nov	Dec	
April	1		1		1		1			4
May		1		1		1		1		4
June			1			1		1		3
July				1		1		1		3
August					1	1		1		3
September						1		1		2
October							1	1		2

Soils in the sugar industry vary from sandy to heavy clays, necessitating more frequent irrigations on the sandy soils compared to the heavy soils. Growers need to carry out field soil inspections and canopy views to check the extent of the damage due to the reduced irrigation water applied. Cane must have at least three green leaves to show that the stool is still alive and viable for the next crop.

2.2 Guidelines on Pre and Post-harvest irrigation

Drying-Off

The time between the last irrigation event and the next harvesting operation is called the dry-off period. It is highly dependent on the soil type and its Total Available Water (TAW). Under normal conditions, the recommended dry-off period is 2 x TAW. During the drought period, growers are advised to extend the dry-off period to 3 x TAW. This will save and spread the available water on the farm for continued irrigation.

Table 4 shows the dry off in weeks from May to December for the different TAW and soil sets in the sugar industry. It assumes that the field capacity was achieved at the final irrigation before harvest. As an example, a field with 100mm TAW to be harvested on 31 July would be dried off for 11 weeks. (Dry- off would begin on 19 May and harvested on 31 July = 11 weeks).

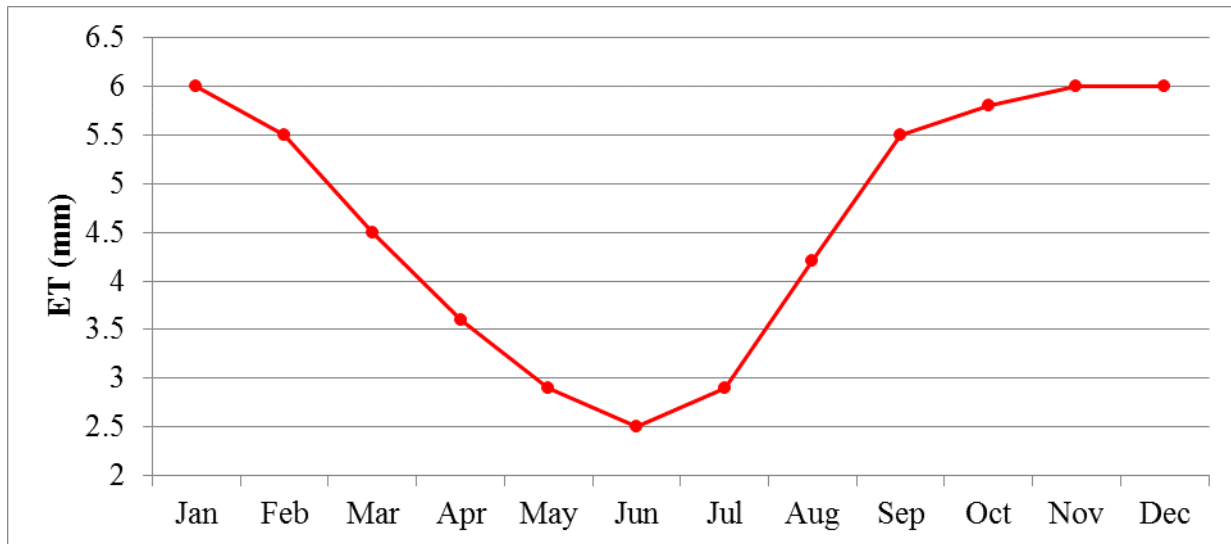
Table 4. Dry off in weeks, working back from the harvest date [3 x TAW]

Month of Harvest	Total Available Water (TAW)				
	50 mm	75 mm	100 mm	125 mm	150 mm
Soil Sets	S, De (Z,H,F)	T, K V, C	Dt, Ro	Rk, B W	Rt, L
May +	5	7	8	11	12
Jun	6	8	10	12	14
July	6	9	11	13	15
August	5	8	11	14	16
September	4	6	9	12	15
October	4	5	7	9	12
November	3	5	6	8	10
December	3	4	6	8	9

Management of the first irrigation after harvesting

The harvesting season normally begins in April each year. This will be a difficult year under the prevailing drought conditions. Growers need to be aware that it coincides with the period when the evapotranspiration (ET) is on the decline as shown by **Figure 2**. Therefore, the crop will survive even with minimum irrigation.

Figure 2: Crop water demand for the Lowveld



First Irrigation

Since the soil is likely to be very dry after harvesting due to the long dry-off period, hence growers must quickly apply the first irrigation, within a week after harvesting. Lengthy delays will affect ratooning and hence reduce plant population because any regrowth under very dry conditions results in die back which in turn will have adverse effects on yields. The first irrigation must bring the soil moisture to field capacity or up to the full TAW of the soil. This is because the young ratooning crop needs moisture to develop a tangible roots system.

Second and Subsequent Irrigations

As the drought is ongoing, the second irrigation should be delayed until the 5th leaf (stem elongation) stage or for a month or two as shown in **Table 3**. This will just keep the cane alive. Subsequent irrigations should be applied in two month intervals.

It is possible that there will be some rainfall events occurring, thus growers are advised to schedule their irrigation accordingly. The decision to irrigate or not to irrigate after such rainfall events will depend on the amount of rainfall received and the resultant soil water content.

Summer and Normal rainfall Guidelines

Even when the drought is over, growers must continue to be vigilant in using water. Irrigation scheduling should continue. The crop water demand varies according to season of harvest and the growth stage of the crop. Sugarcane has different canopy factors (CF) for each growth stage and this should be considered when scheduling. The appropriate water demand of the crop at a given growth stage is calculated by multiplying the ET figure with the CF before subtracting it from the previous soil moisture value. **Table 5** shows canopy factors by harvest month for the Lowveld. The irrigation scheduling must take into account constraints of the irrigation system design in order to provide an optimum soil moisture for an optimal yield. Moisture stress can be avoided by maintaining the soil moisture content between field capacity and half of the soil TAW. With the prevailing weather resulting in diminishing water resources, growers are advised

to use water sparingly. Strict irrigation scheduling should be followed and where possible spreading the available water over a longer period is strongly recommended. Growers are advised to use scheduling tools such as auger, profile pit, probes, pin peg board, Profit and Loss book, and irrigation software (CaneSched).

Table 5: Canopy factors by harvest month for the Lowveld

Harvest month	Current month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Apr	1	1	1	0.4	0.4	0.6	0.78	0.93	1	1	1	1
May	1	1	1	1	0.4	0.4	0.4	0.49	0.76	0.96	1	1
Jun	1	1	1	1	1	0.4	0.4	0.4	0.46	0.8	1	1
Jul	1	1	1	1	1	1	0.4	0.4	0.4	0.73	1	1
Aug	1	1	1	1	1	1	1	0.4	0.4	0.58	0.9	1
Sep	1	1	1	1	1	1	1	1	0.4	0.4	0.7	0.95
Oct	1	1	1	1	1	1	1	1	1	0.4	0.4	0.78
Nov	0.81	1	1	1	1	1	1	1	1	1	0.4	0.46
Dec	0.45	0.83	1	1	1	1	1	1	1	1	1	0.4

2.3 Other Strategies

2.1 Close Monitoring of Water Use: River Basin authorities to keep records of water abstractions in the major rivers. Enforcement of water use as per allocations and authorised usage. Establishing threshold river and major dam levels, including early warning reporting.

2.2 Trans-boundary Water Distribution: Installation of infrastructure to transfer water from one river course/basin to another to be considered, through pumping or canal networks depending on topography. For example, the water at Komati could be shared with sugarcane growers in the Mbuluzi River system. Another example would be transferring water from Lubovane dam to the Big Bend and Nsoko areas.

2.3 Construction of Dams: More dams (both large and small) need to be constructed to capture water along rivers which is normally lost to Mozambique and South Africa during periods of normal flow and especially during floods.

2.4 *Weather and Climatic Forecasts*: Reporting and observance of medium and long-term climatic conditions. Planning crop cycles according to projections as given by weather and climatic experts in the forecasted scenarios.

2.5 *Increasing Utilisation of Underground Water*: Reliance on rivers and dams for water supply, either for irrigation or household consumption, has limitations especially during periods of severe drought. It is recommended that investments be made to increase the contribution of underground water to the water supply system, especially for household use with priority being given to the worst affected areas. This includes removing the prohibition of boreholes in urban areas.

2.6 *Storing Water from Furrow Fields*: This entails giving consideration to collecting run-off water at the end of furrow irrigated fields for re-use downstream. This can be stored in small dams at the bottom of the fields.

2.7 *Change of Irrigation Systems*: This entails sponsoring the conversion of most of the furrow irrigated fields to more efficient irrigation systems like drip in order to consume less water.

3.0 Primary seedcane

3.1 Introduction

Out of the total of 1 550 tons ordered for autumn 2016, about 1305,1tons was estimated to be available as at 12 February 2016, which indicates a shortfall of 15,8% as a result of water shortage. The biggest shortfall was on variety N36.

Based on the available seedcane, the HVSCS stakeholder meeting (12 February 2016) concluded as follows;

- Most growers will not take their autumn 2016 orders for planting as they do not have enough water.
- Where possible some of the seedcane will be pushed to spring 2016 in anticipation of the increased demand due to the abandoned fields because of the on-going drought situation (Table1)
- Certain varieties cannot be pushed to spring as the cane is either already old or will be very old at spring time (2016). These varieties should be milled and fields managed for autumn 2017 (Table 1).

Table 1: Autumn 2016 available vs ordered seedcane

Variety	Available Tons	Ordered Tons	Must be used in Autumn 2016	To be carried to spring 2016

M1400/86	23	50	-	23
N23	231	250	231	-
N25	279,3	275	279,3	-
N36	413,2	575	257	156,2
N41	102,4	125	-	102,4
N49	154,7	150	4,7	154,7
N53	49	75	-	49
N57	52,5	50	52,5	-
Total	1305,1	1550	824,5	485,3

3.2 Mitigation measures

Some growers have reported that they have abandoned some of their fields due to the lack of water. The cane in the abandoned fields may die hence an increased seedcane demand is expected in the future. The following are measures to be considered to mitigate the high demand for seed after the drought;

- Identify growers who may have water to irrigate and encourage them to take the available seed at Mdimba for bulking.
- Ubombo to engage SWADE to release some water from Lubovane Dam to irrigate specifically nursery fields.
- Ubombo, RSSC and Tambankulu to re-consider their decision not to plant nurseries this autumn.
- Growers are encouraged to re-register a majority of their secondary nursery fields.
- Hot-water treatment (HWT) of commercial cane for use to plant abandoned fields. Mdimba to be engaged on her capacity to do the HWT. If Mdimba does not have enough capacity to meet the envisaged demand, the industry may have to consider buying another HWT plant.

3.3 Availability of tissue culture seed from Du Roi

Growers were sensitized during the HVSCS stakeholders meeting about the availability of tissue culture seed from Du Roi in Tzaneen. The meeting noted the services from Du Roi but opted to first focus on the points raised above. SSATS will facilitate the importation of the by interested growers plantlets when the need arises.

According to section 16 of the Plant Control Act of 1981, an application for a plant import permit may be made to the Plant Pathologist in the Ministry of Agriculture or may be sent in writing to the Principal Secretary and shall contain the following particulars;

- The full name and residential address of the applicant.
- The name and address of the person from whom it is proposed to obtain the plants.

- The botanical names or the generally accepted popular names, the varietal names of the plants and the number (or tonnes) of each variety which is desired to import.
- The mode of consignment, whether by post or otherwise, and if not by post, the point of entry through which the plants are to be introduced into Swaziland.
- A valid export permit from the country concerned.
- A valid phyto-sanitary certificate from the country of origin of the plant material.
- The exact locality in Swaziland where it is proposed to the plants.

3.4 Decentralization of the scheme

Decentralisation of the scheme was also discussed in the meeting. The growers' representatives in the meeting concluded that contracting the primary seedcane production to Mdimba is still considered the best option since it has proven to produce good quality seedcane since it started. Even though the transport costs remains high, the benefits of guaranteed quality seed still outweigh the costs. However the concern of 'keeping all your eggs in one basket' remains. The drought has highlighted this exposure and the industry needs to consider decentralising the scheme.

3.5 Inspection of abandoned fields

Some growers have reported that they have abandoned certain fields. In Nsoko, the abandoned area is estimated to be over 1000 ha as at 12 February 2016. Crop Protection will work with the growers and Extension Officers to make a list of all abandoned fields. Growers are encouraged to continue inspecting all fields to monitor the levels of pests and diseases especially in these times of drought.