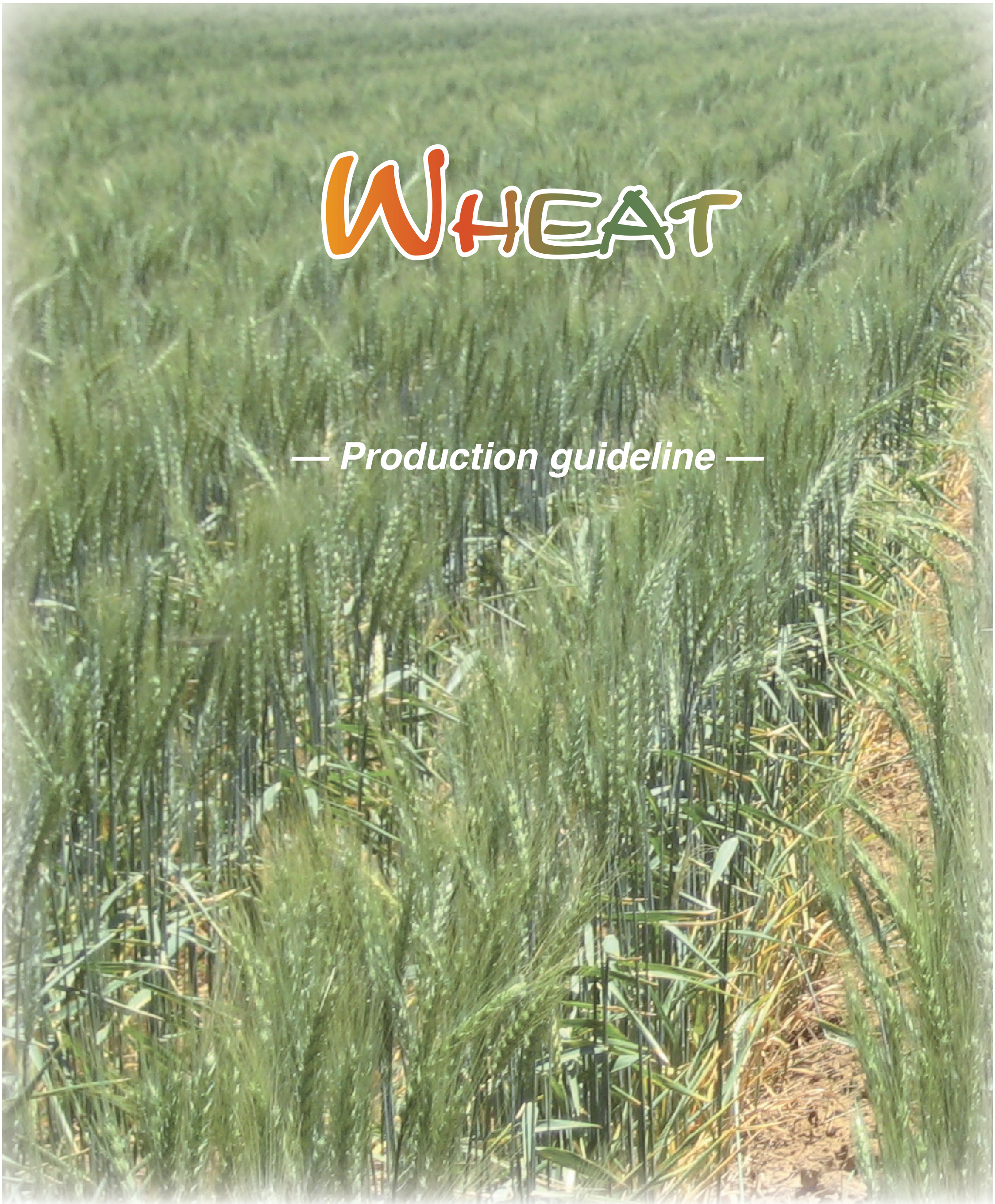
WHEAT

— Production guideline —



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CONTENT

Classification

Scientific name: *Triticum aestivum*

Common names: Wheat, korong, koring, ngolowa, kolo

Origin and distribution

T. aestivum known only under cultivation; its nativity has been lost. The precise origin of the wheat plant, as we know it today is still unknown. Wheat evolved from wild grasses, probably somewhere in the Near East. A very likely place of origin is the area known in early historical times as the Fertile Crescent—a region with rich soils in the upper reaches of the Tigris-Euphrates drainage basin.

Production levels in South Africa

Annual wheat production in South Africa ranges from 1,5 to 3 million t/ha at the rate of 2 to 2,5 t/ha under dryland and about 5 t/ha under irrigation. The south western parts of the Western Cape (Swartland and Rûens) contribute about 650 000 tons, Northern Cape about 300 000 tons, Free State about 580 000 tons, North West about 162 000 tons, Mpumalanga about 92 000 tons, Limpopo and KwaZulu-Natal about 50 000 tons each, and Gauteng and Eastern Cape contribute about 15 000 tons each. South Africa is a net importer of wheat, importing about 300 000 tons per annum.

Major production areas in South Africa

Province	District	Towns
Free State	Xhariep	Bethulie, Bloemfontein area, Orange West, Petrusburg, Jagersfontein, Springfontein, QwaQwa
	Lejweleputswa	Bothaville, Allanridge, Boshof, Dealesville, Goldfields
	Thabo Mofutsanyane	Bethlehem, Arlington, Clarens, Clocolan, Ficksburg, Harrismith
	Northern Free State	Cornelia, Edenville, Frankfurt, Kroonstad, Heilbron, Deneysville
Western Cape	West Coast	Bitterfontein, Clanwilliam, Malmesbury, Koringberg, Rietpoort, Vredendal, West Coast
	Boland	Matroosberg TRC, Breërivier, Witzenberg, Paarl
	Overberg	Overberg,Swellendam, Hermanus, Caledon, Swartland
	City of Cape Town	Blaauberg, Tygerberg, Helderberg, Oostenburg, South Peninsula, West Coast
North West	Dr Ruth Segomotsi Mompati	Christiana, Schweizer-Reneke, Reivilo, Taung
	Dr Kenneth Kaunda	Klerksdorp, Potchefstroom, Wolmaransstad
	Bojanala	Vryburg, Rustenburg, Brits
Northern Cape	Francis Baard	Hartswater, Jan Kempdorp, Pampierstad, Warrenton, Vaalharts
Mpumalanga	Gert Sibande	Badplaas, Carolina, Standerton, Ermelo
	Nkangala	Highveld DC, Delmas, Kriel, Ogies, Hendrina, Middelburg, Groblersdal
Limpopo	Waterberg	Thabazimbi and vicinity Marble Hall
Eastern Cape	Amatole Ukhahlamba Chris Hani	Keiskammahoek, Sterkspruit, Whittlesea

Cultivars

Cultivar choice is an important production decision and if planned correctly, could contribute greatly to reducing risk and optimising yields. The decision is complicated by all the different factors that contribute to the adaptability, yield potential, agronomic characteristics and disease risks of the current commercially available cultivars. The correct cultivar choice contributes to management of risk and achieving optimal grain yield in a given situation. A few important guidelines to consider when the producer is deciding on cultivar choice are:

- Plant a range of cultivars to spread production risks, especially in terms of drought and disease occurrence. Utilise the optimum planting spectrum of the cultivars in an area.
- Do not, within one season, replace a well-known cultivar with a new and unknown cultivar. Rather plant the new cultivar alongside the stalwart for at least one season to compare them and to get to know the new cultivar.
- Cultivars that are able to adap to specific yield potential conditions should be chosen.
- Revise cultivar choice annually to adapt to changing circumstances.

The National Chamber of Milling annually publishes a list of cultivars that are acceptable for commercial purposes, and this list must be considered in cultivar choice and individual miller's choice is not restricted to the list. The list of preferred cultivars is divided into three categories: cultivars for dryland production in the northern and southern areas and irrigation cultivars.

Miller's preference list of preferred bread wheat for 2009/10 in the southern production areas

Baviaans	SST 056	Adam Tas
Biedou	SST 064	Alpha
Kariega	SST 067	Gamtoos
PAN 3404	SST 087	Karee
PAN 3408	SST 57	Multilyn Z
PAN 3490	SST 65	Nantes
PAN 3492	SST 75	Palmiet
SST 015	SST 825	Scheepers 69
SST 026	SST 88	SST 38
SST 027	SST 94	SST 44
SST 035	Steenbras	T4
SST 047	Tankwa	Tugela
		Tugela DN

Miller's preference list of preferred bread wheat for 2009/10 in the northern production area—dryland production areas

Miller's preference		Undesirable cultivars
Belinda	PAN 3379	Adam Tas
Betta DN	SST 107	Alpha
Caledon	SST 124	Gamtoos
Carina	SST 308	Karee
Carol	SST 319	Multilyn Z
Elands	SST 322	Nantes
Gariep	SST 333	Palmiet
Hugenoot	SST 334	Scheepers 69
Komati	SST 347	SST 38
Limpopo	SST 356	SST 44
Matlabas	SST 363	T4
Nossob	SST 366	Tugela
PAN 3118	SST 367	Tugela DN
PAN 3120	SST 374	
PAN 3122	SST 387	
PAN 3144	SST 399	
PAN 3161	SST 935 (B)	
PAN 3172	SST 936	
PAN 3191	SST 946	
PAN 3211	SST 954	
PAN 3232	SST 963	
PAN 3235	SST 964	
PAN 3349	SST 966	
PAN 3355	SST 974	
PAN 3364	SST 983	
PAN 3368	Tarka	
PAN 3377		

Miller's preference list of preferred bread wheat for 2009/10 in the northern production areas—irrigation production areas

Miller's preference		**Undesirable cultivars**
Afgri 75-3	SST 802	Adam Tas
Baviaans	SST 822	Alpha
Buffels	SST 825	Gamtoos
CRN 826	SST 835	Karee
Duzi	SST 8867	Multilyn Z
Inia	SST 874	Nantes
Kariega	SST 8875	Palmiet
Krokodil	SST 876	Scheepers 69
Marico	SST 884	SST 38
Olifants	SST 885	SST 44
PAN 3471	SST 886	T4
PAN 3434	Steenbras	Tugela
PAN 3478		Tugela DN

Description of the plant

Mature plant

Wheat is an annual grass with basic, erect, hollow or pithy culms. The plant can grow up to 1,2 m tall. The leaves are flat and narrow while they can extend up to 38 cm long. The spikes are long, slender, dorsally compressed and somewhat flattened. The rachis is tough and not separated from the spikelet at maturity. The spikelets have 2 to 5 flowers, which are relatively far apart on the stem and slightly overlapping. They are also erect and pressed close to rachis. The glumes which are firm, glabrous and shorter than the lemmas, appear on the upper half of the spikelets. The lemmas may either be awned or awnless and less than 1,3 cm long. The palea is as long as the lemma and remains entirely green until maturity. The caryopsis may either be soft or hard and red or white and it frees easily with threshing.

Climatic requirements

Temperature

Warm temperatures are suitable for summer wheat (22 ° to 34 °C) and cool temperatures are suitable for winter wheat (5 ° to 25 °C). An ideal climate for planting wheat can be described as cool and moist, followed by a warm dry season for harvesting. Such a climate is encountered mostly in winter rainfall areas. In South Africa wherein most of the country receives summer rainfall, winter wheat production is dependent on sufficient residual soil moisture.

Rainfall requirements

The water requirement for wheat is about 600 mm per annum. In dry areas where cultivation practices such as zero tillage and minimum tillage are practised, stubble mulching is recommended for moisture conservation. Frost can damage wheat, especially after the formation of ears in spring resulting in low yield. Hail can also result in serious damage on the summer wheat, resulting in low yield. Wet weather during harvesting contributes to disease prevalence and quality deterioration of grains. The moisture application under irrigation should be lowered during flowering, increased during pod filling and cease during ripening.

Soil requirements

Well-drained fertile loamy to sandy loam with pH of 6,0 to 7,5. Soil temperatures of less than 5 °C are not suitable for seed germination. Wheat is adversely affected by acidic soil, which are associated with high (Al_{3+}) content, particularly during the early development stages of the crop. The acidic pH causes other soil nutrients to be fixed or to become unavailable, leading to a need for liming.

CULTIVATION PRACTICES

Propagation

Wheat is propagated by seeds.

Soil preparation

Soil tillage is one of the important production practices over which the farmer has full control. The effect of tillage cannot be predicted for any season. Therefore the farmer has to plan his actions to solve specific problems. Unnecessary cultivations cost money, time and effort, while valuable soil water is lost in the process. Such cultivations also cause recompaction that has to be addressed later. Minimum tillage (75 to 130 mm deep), deep tillage (150 to 300 mm) or no till can be practised, depending on the soil type, moisture availability, type of cultivar and the previous crop planted.

Planting date and plant densities for wheat in the southwestern Free State

Cultivar	Planting date (weeks)																Plant density (kg/ha)
	April				May				June				July				
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	
Caledon (PBR)					■	■	■	■	■	■							20–30
Elands(PBR)					■	■	■	■	■	■							15–20
Gariep(PBR)					■	■	■	■	■	■	■	■					15–20
Komati(PBR)						■	■	■	■	■							15–30
Limpopo(PBR)					■	■	■	■	■	■	■	■					15–20
Matlabas(PBR)					■	■	■	■	■	■	■						20–25
PAN 3118(PBR)				■	■	■	■										15–20
PAN 3144(PBR)				■	■	■	■										15–20
PAN 3349(PBR)					■	■	■	■									15–30
PAN 3355(PBR)					■	■	■	■	■	■							20–30
PAN 3364(PBR)				■	■	■	■	■	■	■	■						15–20
PAN 3368(PBR)					■	■	■	■	■	■							20–30
PAN 3377(PBR)					■	■	■	■	■	■							20–30
SST 322(PBR)							■	■	■	■	■	■					30–40
SST 356(PBR)					■	■	■	■	■	■							20–30

* All the abovementioned cultivars qualify for all the grades of the bread class
* PBR cultivars protected by Plant Breeders' Rights

Field layout and design

Firm, smooth, well-drained fields should be selected. The field should be free of weeds, stones and waterlogged conditions. Contour ridges, ridges, field waterways, terraces or windbreaks should be introduced into the field to prevent wind and water erosion. Avoid using field where wheat was planted the previous or same year.

Planting

Wheat is planted mainly between mid-April and mid-June in the winter rainfall areas (western and southern Cape) and between mid-May and the end of July in the summer rainfall areas (eastern Free State).

The seed should be planted evenly and shallowly in a moist, firm seedbed. Germination, emergence and development of adventitious roots occur within 4 to 6 weeks after planting under proper soil conditions. The required depth for seedings is 2 to 5 cm. The required spacing in the row is about 30 cm and 50 to 100 cm between the rows, depending on the available soil moisture or the farming method (wide rows under dryland and narrow rows under irrigation). A no-till planter can be used for seeding or a planter fitted with tines can be used for planting. The planting density ranges from 20 to 100 kg/ha, depending on the type of cultivar and the moisture availability. Lime can also be used to correct the soil pH under acidic soil. $MgCO_3$ or $CaCO_3$ can be used to correct the soil pH; the rate will depend on the available Mg or Ca in the soil.

Fertilisation

Fertilisation in the winter rainfall region

The contribution of plant nutrition to the total production cost for wheat in the Swartland wheat-producing area may be well in excess of 30 %. The soil tillage method may have an effect on both the efficient use of fertiliser applications and N-mineralisation that contributes to the cost of plant nutrition. Efficient use of fertiliser is affected by fertiliser placement (uptake) and root distribution. To improve their uptake, fertilisers such as phosphorus that do not move easily in the soil, must be placed near the roots. Efficient root distribution is affected by soil strength.

N-mineralisation of the soil is determined by climate, soil conditions and method of soil tillage. N-mineralisation in the soil could provide large quantities of nitrogen in crop rotation systems, which include legume plants and systems such as conservation farming where microbial activity in the soil is high. Although aggressive mouldboard ploughing may enhance N-mineralisation in the short term, negative effects on soil structure, organic content and soil microbial activity may result in a reduction in the long term.

Effect of crop rotation, method of soil tillage and N-fertilisation on grain yield (kg/ha)

Production system	**N rate (kg N/ha)**		
	60	**100**	**140**
Wheat monoculture:			
Mouldboard*	3 516	3 724	3 744
Minimum tillage**	3 303	3 640	3 973
No tillage***	2 390	3 105	3 363
Wheat in rotation with lupins and canola:			
Mouldboard*	3 098	3 038	3 093
Minimum tillage**	2 864	3 408	3 159
No tillage***	3 147	3 516	3 537

Fertilisation guidelines in the summer rainfall regions—Nitrogen fertilisation (kg N/ha) according to target yield under irrigation

Target yield (ton/ha)	**Nitrogen (kg N/ha)**
4–5	80–130
5–6	130–160
6–7	160–180
7–8	180–200
8+	200+

Split application of N during the growing season at different levels of yield potential

Yield (t/ha)	Nitrogen split applications (kg N/ha)		
	lant to tillering	Tillering to stem elongation	Flag leaf to anthesis
4–5	80–100	30	0
5–6	100	30	30
6–7	100–130	30	30
7–8	130–160	30	30
> 8	160	30–60	30–60

Phosphorus fertilisation under dryland—Phosphorus fertilisation (kg P/ha) according to target yield and soil status according to the Bray 1 analysis method

Target yield (t/ha)	Soil phosphorus status (mg/kg)			
	> 5*	5–18	19–30	> 30
1,0	6	5	4	4
1,5	9	8	6	5
2,0	12	12	8	7
2,5+	18	15	12	10

* Minimum quantity that should be applied at the low soil phosphorus level

Phosphorus fertilisation under irrigation—Phosphorus fertilisation (kg P/ha) according to target yield and soil status according to the Bray 1 analysis method

Target yield (t/ha)	Soil phosphorus status (mg/kg)			
	> 5*	5–18	19–30	>30
4–5	36	28	18	12
5–6	44	34	22	15
6–7	52	40	26	18
7+	> 56	> 42	> 28	21

Potassium fertilisation under dryland conditions—guidelines for potassium fertilisation (kg K/ha) under dryland conditions according to soil texture, soil potassium levels and target yield

Target yield (t/ha)	Soil potassium status (mg/kg)			
	<60	**61–80**	**81–120**	**>120***
1–2	20	15	15	0
2–3	30	20	20	0
3+	40	25	25	0

* Soil with > 35 % clay (soil with < 35 % clay content, no potassium recommended, but potassium applications may be done for maintenance of soil K values)

Guidelines for potassium fertilisation (kg K/ha) under dryland conditions according to soil potassium levels and target yield

Target yield (t/ha)	Soil potassium status (mg/kg)			
	<60	**61–80**	**81–120**	**>120***
4–5	50	25	25	0
5–6	60	30	30	0
6–7	70	35	35	0
7+	80	40	40	0

* Soil with > 35 % clay (soil with < 35 % clay content, no potassium recommended)

* On < 35 % clay soils, K applications may be split during the growing season to ensure K availability in the topsoil

Micronutrients

Iron, manganese, zinc, copper and boron are essential for normal development and growth of wheat. If one or more of these become deficient, visual deficiency symptoms will appear on the leaves. Deficiency must be corrected early in the growing season to prevent any further yield losses. At this stage micronutrients are not generally recommended under dryland practices, because of the risks involved to recover the additional input costs. Under specific conditions, where micronutrients are the yield limiting factor (plant analysis), the following table can be used to determine which nutrient is causing the problem.

Plant analysis values of wheat at flag-leaf stage

Element	Low (deficient)	Marginal	High (sufficient)
N (%)	< 3,4	3,7–4,2	> 4,2
P (%)	< 0,2	0,2–0,5	> 0,5
K (%)	< 1,3	1,5	> 1,6
S (%)	< 0,15	0,15	> 0,4
Ca (%)	< 0,1	0,2	> 0,2
Mg (%)	< 5,0	0,15	0,15–0,3
Cu (mg/kg)	< 20,0	5–10	10,0
Zn (mg/kg)	< 30,0	20–70	> 70,0
Fe (mg/kg)	< 25,0	35–100	> 100,0
Mo (mg/kg)	< 0,05	50–180	> 180,0
B (mg/kg)	< 6,0	0,05–0,1	> 0,1
		6–10	10,0

Irrigation

Irrigation scheduling must be according to evaporation and needs, as per growth stage. It is, however, very important that irrigation is not stopped too early and the last irrigation must be applied when the total plant is almost discoloured. This is to ensure an even ripening and to produce grain with a high percentage plumpness and acceptable nitrogen content. Proper irrigation scheduling can also minimise lodging and disease occurrence and optimise yield quality. The method of irrigation will depend on the water availability and the available irrigation equipment.

Pest control

A variety of insects with different feeding habits are found on wheat but not all these pests are equally damaging. Therefore the decision to control pests should be made individually for each pest using the guidelines provided and the particular control measure should be chosen to give the best results in both economic and environmental terms. The correct identification of pests is of utmost importance to ensure that the appropriate control measure is followed.

A field guide for the identification of insects in wheat is available from the ARC-Small Grain Institute and information on the registered insecticides.

Pests in the winter rainfall regions

Aphids

Aphid species, causing problems in the winter rainfall area are mainly oat aphid, English grain aphid and rose grain aphid. Russian wheat aphid, which is the most severe wheat aphid in SA, is a sporadic pest in this area. The former aphids prefer high plant densities with damp conditions, which are typical of the winter rainfall region as well as irrigated fields. During dry conditions in this area aphid numbers are low, with the exception of the Russian wheat aphid, which prefers dry conditions.

Other insect pests

Bollworm

The presence of bollworm is generally noticed only once the larvae have reached the mid-instar stage inside the awns. Producers should scout their fields in order to detect the younger larvae, as the older, more matured larvae, are generally less susceptible to insecticides and obviously cause more damage compared to small larvae.

Chemical intervention can be considered when 5 to 8 larvae are present per square metre. However, producers should take care in applying the correct dose of registered insecticide under weather conditions conducive to insect control.

Grain chinch bug

Damage is more pronounced under warm, dry conditions as stressed plants have less ability to tolerate/recover from chinch bug damage. There are no insecticides registered against this insect on wheat.

Grain slug

The symptoms include a white, longitudinal stripe development on damaged leaves. Currently, no insecticides are registered on wheat.

Black sand mite or redlegged earth mite

Symptoms: silvery, white scars adjacent to the main vein of especially older leaves. Dying off of small plants. A single systematic insecticide is registered although no threshold value is available.

Pests in the summer rainfall regions

The Russian wheat aphid and other aphids that were discussed earlier, brown wheat mite, false wireworm, black maize beetle, leafhoppers and maize streak virus.

Pest	Symptoms	Control measure(s)
Russian wheat aphid	Young plants: stunted and the leaves rolled tightly closed Mature plants: longitudinal, white or pale yellow stripe, later purple, tightly rolled leaves and trapped heads	Plant cultivar with RWASA1
Brown wheat mite	Mottled leaves due to sap-feeding and later yellow or bronze, resulting in yellow or brown patches	Chemical control
False wireworm	Feeding on seed, roots and seedling stems by larvae, and adults damage emerging seedlings	• Cultural practices to reduce population as adult cannot fly • Seed treatment
Black maize beetle	Adults chew on seedling stem, resulting in reduced plant stand	Seed treatments
Leafhoppers and maize streak	Young plants are stunted with curled leaves with white longitudinal stripes	• No chemical control of leafhoppers on wheat • Can be prevented by later planting dates in areas away from maize field

Available cultivars with resistance to RWASA1 developed by different organisations

ARC-SCI	MONSANTO1	PANNAR2
Betta-DN Gariep Matlabas	SST 966 SST 399 SST 322	PAN 3364 PAN 3235 PAN 3144*
Limpopo Caledon Elands Komati	SST 334 SST 935 SST 946	PAN 3355

Diseases and weeds

While wheat diseases such as eyespot, take-all and crown rot, as well as weeds such as gut brome and ryegrass, are important grain yield limiting factors in the Western and Southern Cape, it is a well known fact that crop rotation with a leguminous crop is the most efficient method of controlling these problems. In such systems the effective chemical control of grass weeds in the nongrass crop is essential.

Should monoculture, however be practised, these problems can be curtailed by burning the residue or by deep mouldboard ploughing. Owing to the high costs associated with mouldboard ploughing, the first alternative is preferred. The continuous burning of stubble residue will, however, increase the erodibility of the soil and damage the soil structure. For this reason it must be applied judiciously.

Weeds limit grain yields by approximately 20 % annually. By alternating crops and changing herbicides, it is possible to control a wider spectrum of weeds. Effective weed control in one crop often means that the following crop can be grown without the need of expensive selective herbicides. Rotating crops and herbicides reduce the potential for herbicide resistance to develop in target species, for example wild oats. This can also reduce the potential for herbicide residue accumulation in the soil.

Diseases of small grains in the winter rainfall regions

Disease group	Disease	Symptoms	Control
Rusts	Stem rust	Large parts of the stem appear reddish brown	Foliar fungicides at the seven-leaf and again at flag-leaf stages
	Leaf rust	Orange-brown elliptical pustules on the leaves and on the ears under high-disease pressure	
	Stripe rust	Yellow-orange pustules in narrow stripes of the leaf sheaths and inner surfaces of glumes and lemmas of the heads	
	Crown rust	Bright orange to yellow coloured elongated oval pustules on leaves, sheaths and floral structures	

Disease group	Disease	Symptoms	Control
Mildew		Fluffy, white pustules become grey as age and later white fungal growth covers the entire plant	Foliar application of fungicides
Spots and blotches	Scald or leaf blotch	Pale grey patches on the leaf surfaces and later the entire leaf, and the leaf may die off	Planting disease-free seed, removal of volunteer plants and foliar fungicides
	Net blotch	Dark brown streaks across leaf length with a net-like appearance or brown to black elliptical lesions	Planting high-quality disease-free seed, the use of resistant cultivars though not available in SA yet
	Tan spot	Small, tan coloured flecks occur on leaves and sheath	Registered fungicides
Septoria	Leaf blotch	Small, brown spots, which later form elongated ovals then fruiting bodies. Severe necrosis	Disposal of contaminated crop debris by burning or ploughing it into the soil. Foliar fungicides
	Glume blotch	Oval lesions that coalesce to form larger areas of necrotic tissue form on the leaf	Disposal of contaminated crop debris by burning or ploughing it into the soil. Foliar fungicides
Ear and grain	Loose smut	Early emergence on ears with dark colour and slightly longer than the healthy ones. Spikelets transformed into powdery masses of dark brown teliospores	The use of high-quality, disease-free seed
	Karnal bunt	Kernels become blackened, eroded and emit a foul ‘fishy’ odour	Preventing the entry of the pathogen into a certain area
	Eye spot, Strawbreaker	Eye or lens-shaped eye spot lesion on mature wheat below the first node, premature ripening of the ears	The ploughing or burning of small grain cereal crop residue. Application of fungicides

Other diseases in the summer rainfall region

Virus diseases

Maize streak

The symptoms of this disease include fine, linear, chlorotic leaf streaks, shortened tillers, leaves and spikes and excessive tillering and sometimes leaves have bent and curled tips. The disease can be avoided by planting in areas where maize and grasses are infected, planting resistant cultivars and controlling leafhopper populations.

Fungal diseases chemical control

Fungicides are routinely used for control of foliar disease, ear, grain and stem diseases. In South Africa various active ingredients are registered for the control of foliar diseases on wheat

Active ingredients of fungicides registered for the conrol of foliar disease, ear, grain and stem diseases

Active ingredient	Wheat diseases			
	Stem rust	**Leaf rust**	**Stripe rust**	**Powdery mildew**
Bromuconazole		X	X	X
Carbendazim/ Cyproconazole		X	X	X
Carbendazim/ Epoxiconazole		X	X	X
Carbendazim/ Propiconazole		X	X	X
Carbendazim/ Propiconazole		X	X	X
Cyproconazole		X	X	X
Epoxiconazole		X	X	X
Flusilazole		X		
Flusilazole/ Carbendazim	X	X	X	X
Propiconazole	X	X	X	X

Active ingredient	Wheat diseases			
	Stem rust	Leaf rust	Stripe rust	Powdery mildew
Propiconazole/ Cyproconazole	X	X	X	X
Tebuconazole	X	X	X	X
Tebuconazole		X	X	X
Tetraconazole	X	X	X	X
Triadimefon		X		

Active ingredient/s of fungicides registered for the control of seed-borne diseases of small grains

Active ingredient	Seed-borne diseases				
	Loose smut wheat	Loose smut barley	Loose smut oats	Covered smut barley	Covered smut oats
Carbonxin/Thiram	X	X		X	
Mancozeb				X	
Tebuconazole	X	X		X	
Thiram			X	X	X
Triadimefon			X		
Triadimenol	X	X	X	X	X
Triticonazole	X	X		X	

Harvesting

Harvest maturity

Wheat grains must be dry before it can be harvested. Wheat is harvested in the November/December period but later harvestings are applicable in the case of spring and summer wheat. Only fully ripened grains should be harvested. Harvesting should commence at 16 % grain moisture content while lower moisture contents up to 13 % are preferred for storage. The shattering types must be harvested earlier and dried artificially.

Harvesting methods

A machine called a combine is used to cut, separate and clean the grain. A combine must be properly adjusted to minimise grain losses.

Special tools were developed for harvesting wheat:

- Reaping—the sickle and scythe are tools that are used to cut and harvest wheat in the past. Mechanical reapers eventually replaced the hand tools.
- Threshing—this is the separating of the grain or seeds from the plant material. The cutting and threshing processes were combined into one machine called the combine. It could cut wheat, thresh out the grain, and store it in a bin on the machine.
- Winnowing is the process of separating threshed grain from the chaff.

POST-HARVEST HANDLING

Sorting

Sorting should be done after harvesting, ensuring that all seeds of wheat must

- be free of any toxin, chemical or other substances that render it unsuitable for commercial purposes:
  - provided that not more than 10 microgramme per kilogramme aflatoxin, of which not more than 5 microgramme per kilogramme will be aflatoxin
  - B1 is permissible
- contain not more noxious seeds or ergot sclerotia than permitted in terms of the Foodstuffs, Cosmetics and Disinfectants Act, 1972 (Act No. 54 of 1972)
- be free of organisms of phytosanitary importance as determined in terms of the Agricultural Pests Act, 1983 (Act No. 36 of 1983)
- be free of mould-infected, sour and rancid other grain, foreign matter and any other matter
- be free of any odour, taste or colour not typical of undamaged and sound wheat
- with the exception of Class Other Wheat, be free of insects
- with the exception of Class Other Wheat, be free from stinking smut infection

- with the exception of Class Other Wheat, have a moisture content not exceeding 13 %

Grading

According to the grading system promulgated under the Act on Agricultural Products, only one bread wheat class exists with four grades, namely; B1, B2, B3 and B4 that are determined according to the grain protein content, the hectolitre mass and the falling number. Hectolitre mass, and especially protein content are largely determined by the environment during the grain-filling period to maturity, and by management practices, including soil, water and fertiliser management.

Grading regulations—schematic presentation of classes and grades of bread wheat

Bread wheat – Class B			
Grade	**Minimum protein (12 % moisture basis)**	**Minimum hectolitre mass (kg/ha)**	**Minimum falling number (seconds)**
B1	12	77	220
B2	11	76	220
B3	10	74	220
B4	9	72	200
Utility	8	70	150
Class other	Do not comply to above-mentioned or any other grading regulations		

Packing

Wheat of different classes shall be packed in different containers. Every container or the accompanying sale documents of a consignment of wheat shall be marked or endorsed by means of appropriate symbols specified in subregulation (2), with:

- The class of the wheat
- The grade, in the case of Class Bread Wheat, Class Biscuit Wheat and Class Durum Wheat
- Symbols referred to in subregulation (1) shall appear in the order of class and grade
- Symbols used to indicate the different classes shall be:
  – B in the case of Class Bread Wheat

– C in the case of Class Biscuit Wheat
– D in the case of Class Durum Wheat
– O in the case of Class Other Wheat

- Grades shall be:
  – S in the case of Super Grade
  – 1 in the case of Grade 1
  – 2 in the case of Grade 2
  – 3 in the case of Grade 3
  – 4 in the case of Grade 4
  – UT in the case of Utility Grade

Standards for grades of Class Bread Wheat, Class Biscuits Wheat and Class Durum Wheat

Nature of deviation	Maximum percentage permissible deviation (m/m)					
	Super Grade*	**Grade 1**	**Grade 2**	**Grade 3**	**Grade 4**	**Utility Grade**
(a) Heavily frost-damaged kernels	5	5	5	5	5	10
(b) Field fungi infected kernels	2	2	2	2	2	2
(c) Storage fungi-infected kernels	0,5	0,5	0,5	0,5	0,5	0,5
(d) Screenings	3	3	3	3	3	10
(e) Other grain and unthreshed ears	1	1	1	1	1	4
(f) Gravel, stones, turf and glass	0,5	0,5	0,5	0,5	0,5	0,5
(g) Foreign matter including gravel, stones, turf and glass	1	1	1	1	1	3
(h) Heat-damaged kernels	0,5	0,5	0,5	0,5	0,5	0,5
(i) Damaged kernels, including heat-damaged kernels	2	2	2	2	2	2

Nature of deviation	Maximum percentage permissible deviation (m/m)					
	Super Grade*	Grade 1	Grade 2	Grade 3	Grade 4	Utility Grade
(j) Deviations in terms (d) (e) (g) and (i) collectively: provided that such deviations are individually within the limits of the mentioned items	5	5	5	5	5	5

(f) (g) (h)(i) (j) * Only in the case of Class Durum Wheat

Storage

Wheat should be stored in the silos or dry conditions after harvest in order to avoid damage by moisture, pests, high and very low temperatures. Storage of wheat may take many forms, depending on the market price. Some farmers prefer to store wheat on their farms for some time while studying the markets. Others sell their harvests on contracts or spot price through SAFEX. Some farmers may prefer to store their wheat at the silos at a predetermined rate. However, in most cases the harvest is sold to millers by the time it is transported to the silos.

Transport

Wheat has to be transported to the silos after harvest. Rail trucks and road trucks can be used to transport wheat locally and ships may be used for exporting and importing.

Marketing

The South African wheat market was deregulated on 1 November 1997 and wheat can therefore be traded freely. All grain producers, traders and processors are currently able to trade in a free market, responding to forces of worldwide supply and demand in setting prices. The only government intervention in the market is the tarrif on wheat imports. The wheat prices are influenced by factors such as international wheat prices, the strengthening of the rand against other currencies, international and local wheat supply and weather conditions. The market price is also directed by the future level of prices of different commodities and the expected increase in demand of wheat owing to the biofuel project and the fact that South Africa is importing wheat from other countries for consumption.

Farmers can sell their wheat on contracts through SAFEX while the wheat is in the field. The wheat marketing season in South Africa commences on 1 October and ends on 30 September the following year.

PRODUCTION SCHEDULES

Activities	January	February	March	April	May	June	July	August	September	October	November	December
Soil sampling		■	■	■								
Soil preparation			■	■	■							
Planting (winter)				■	■	■						
Planting (summer)					■	■	■					
Fertilisation			■	■	■	■	■					
Irrigation (winter)			■	■	■	■	■					
Irrigation (summer)				■	■	■	■	■	■			
Pest control					■	■	■	■	■			
Disease control					■	■	■	■	■	■		
Weed control			■	■		■	■	■	■	■		
Thinning (winter)						■	■					
Thinning (summer)								■	■			
Leaf sampling	Before side dressing or 2 months after planting											
Harvesting (winter)								■	■	■		
Harvesting (summer)	■	■							■	■	■	■
Marketing	■	■	■	■	■	■	■	■	■	■	■	■

UTILISATION

Human consumption

Wheat is used mostly as a human foodstuff worldwide. History shows that the first people to consume wheat probably did so 17 000 years ago by chewing kernels of the wild grain. Today the best known and most widely cultivated wheat is used for grain, either whole or ground. Finely ground wheat is the source of flour for the world's bread-making industry. In South Africa, wheat is used mainly for human consumption with a small portion as animal feed. Grain is also a source of alcoholic beverages in some parts of the world.

Industrial utilisation

Other countries produce industrial alcohol into synthetic rubber and explosives. Starch is used for pastes and sizing textiles. Straw is made into mats, carpets, baskets and used for packing material, cattle bedding, and paper manufacturing. Scientists are studying ways to use wheat for other nonfood products such as medicines, makeup and biodegradable plastics.

Bran from flour milling is an important livestock feed, while germ is a valuable addition to feed concentrate. Grain can be fed to livestock whole or coarsely ground. Some wheat is cut for hay. Wheat grown for grain is also used for pasture before the stems elongate and as a temporary pasturage; it is nutritious and palatable.

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