Oats

— Production guideline —

agriculture,
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CONTENT

Classification

Scientific name: *Avena sativa*
Common names: Hawer (Afrikaans), habore (Sotho), oats (English)

Origin and distribution

Oats is believed to be mainly Asiatic in origin. Different kinds of oats probably came from various parts of that continent or Europe. Cultivation of oats was extensive in Europe prior to the discovery of America, and the earliest settlers brought the seed to the new world.

It is found in the fields under continuous cropping of small grains in North Dakota, South Dakota, Minnesota and Montana. It is also found throughout the United States except in the southeast (Alabama, Florida, Georgia, Kentucky, the Carolinas, Mississippi, Arkansas, Tennessee and West Virginia) and the Delmarva Peninsula.

Production levels in South Africa

The local consumption of oats for processing in the cereal market is approximately 40 000 to 50 000 ton. Because of the low quality of oats grain produced (mainly of a low hectolitre mass), a major part of this local grain production is not suited for commercial processing, and the requirement of the market is filled via imports. However, local cultivars have the potential to produce quality oats and the required yield.

Major production areas in South Africa

Because of its wide planting spectrum and adaptability as well as high biomass production, oats are suitable for all regions of South Africa.

Cultivars

The choice of cultivar by a producer depends mostly on the end-market for the production, e.g. grain, grazing or feed. Cultivars that are more suited for grazing and hay production have different characteristics, and a cultivar for grain production must be chosen according to the needs of the buyer and end-user of the product, but must also fit into the production system of the farmer. Once this decision has been made, the chosen cultivar must

Characteristics of oats cultivars

Cultivar	Yield	Mass (H)	Lodging resistance	Plant height (cm)	Crown rust resistance	Stem rust resistance	Use
Overberg	Good	Good	Good	80	MS	MR	Grain/Grazing
Sederberg	Average	Average	Reasonable	90	MS	MS	Grain/Grazing
Kompasberg	High	High	High	75	MR	MS	Grain/Grazing
Heros	Average	Average	Reasonable	85	S	S	Grain
Witteberg	Good	Average	Average	100+	S	S	Grazing
Pallinup	High	High	Good	80	MS	MS	Grain
Potoroo	Good	High	Good	80	MR	MR	Grain
SSH 491[2]	High	High	Good	90	MR	S	Grain
SSH 405	Average	Average	Reasonable	85	S	S	Grain
SSH 421[2]	Average	Average	Average	90+	—	—	Grazing
Drakensberg	Good	Average	Reasonable	100+	R	MS	Grazing/Silage
Maluti	Average	Average	Average	100+	MS	MS	Grazing
SSH 39W2	Average	Average	Average	100+	—	—	Grazing
SWK 001	Average	Average	Average	100+	MR	MS	Grazing
Le Tucana[1]	Higher yield and better cold tolerance than Drakensberg						Grazing

[1] Marketed by Pannar
[2] Marketed by K2 Agri-seed (Klein Karoo Seed)

S – Susceptible
MS – Moderately susceptible
R – Resistant
MR – Moderately resistant

be planted and all production practices optimised as shown in the cultivar tables. Certified seed must be used to ensure that the correct cultivar is planted for the proposed end-user, and to ensure good germination and seedling establishment.

Planting spectrum of currently available cultivars in the cooler irrigation areas

Cultivar	May				June				July			
	1	2	3	4	1	2	3	4	1	2	3	4
Kompasberg												
Sederberg												
Overberg												
Heros												
SSH 405												
SSH 491												
Pallinup												

Planting spectrum of currently available cultivars in the warmer irrigation areas

Cultivar	May				June			
	1	2	3	4	1	2	3	4
Kompasberg								
Sederberg								
Overberg								
Heros								
SSH 405								
SSH 491								
Pallinup								

Seeding density: The target plant population (plants/m²) for the early planting is 175 to 200, for plantings in the middle of the spectrum 200 to 275, and for late plantings 275 to 350. Depending on the specific seed lot and thousand kernels mass the seeding density can range from 60 to 100 kg of seed per hectare.

Planting spectrum of currently available cultivars for dryland in the eastern highveld

Cultivar	May				June				July			
	1	2	3	4	1	2	3	4	1	2	3	4
Kompasberg												
Sederberg												
Overberg												
Heros												
SSH 405												
SSH 491												
Pallinup												

Description of the plant

Oats, like wheat, are an annual grass and belong to the Gramineae family, genus *Avena*.

Roots

The plant has two root systems, the seminal and the adventitious. The seminal roots originate during the development of the embryo and consist of the primary root (radicle) and two or three lateral roots which arise in the first node. Adventitious roots arise in the nodes of the main stem and of the tillers just beneath the soil surface. The adventitious roots constitute the major root system of the plant. Root development is fibrous and will vary according to the above-ground growth as well as maturity, but is approximately 1 m deep.

Stem

Each plant produces about five stems, depending on the growth season. Each stem produces a terminal panicle where the seeds develop. The stem is composed of a series of nodes and internodes. The

nodes are solid. The elongated internodes of the mature stem are hollow in the centre, but during the early vegetative stage of development the internodes are solid.

Leaves

The leaf consists of the blade, sheath and ligule. Leaves develop at regular intervals until panicle emergence. The blade is elongated, flat, narrow and linear. The margin of the blade is entire and its tip is acute. The leaf sheath is an open cylinder. In the young plant the sheath of the older leaves encloses all or a portion of the elongated internodes above it.

Flowers

The flower consists of a lemma and a palea, two lodicules, three stamens, and one pistil. Flowering or anthesis occurs when pollen is shed on the feathery stigmas enclosed by the lemma and palea with outer tissue called glumes.

Tillers

The oat inflorescence is a loose, open panicle. The main axis of the panicle is a continuation of the stem and it ends in a single spikelet. The spikelet consists of two empty glumes (bracts) on a rachilla, which bears several flowers, but usually only the two basal flowers are fertile.

Ear

The oat inflorescence is a loose, open panicle. The main axis of the panicle is a continuation of the stem and it ends in a single spikelet. The spikelet consists of two empty glumes (bracts) on a rachilla, which bears several flowers, but usually only the two basal flowers are fertile.

Grain

The mature grain consists of a groat or caryopsis tightly covered by a hull. The hull represents between 30 % and 40 % of the total grain weight. It comprises cellulose, hemicellulose and lignin. The oat groat is long, slender and elliptical in shape and covered with hairs under the hull. There is a groove on the inner surface that extends over the entire length of the groat. The embryo is located on the anterior side near the base of the groat. There are two major parts to the embryo, namely the scutellum (or cotyledon) and the primary axis of the embryo, which is composed of the plumule and the primary root (or radicle).

Groat versus hull

The kernel is enclosed by two hulls that are worthless to the industry. Plenty of groats and few hulls are therefore needed and processors require no more than 30 % hulls against 70 % or more groats. This characteristic is generally also reflected in the hectolitre mass and is environmentally as well as genetically determined. In shrivelled grains the hulls make out a greater percentage of the groats:hull ratio and in this case is undesirable.

Climatic requirements

Temperature

Small grains in the germinating, seedling and vegetative stages are not sensitive to low temperatures and frost. Winter types require very low soil temperatures (3 °C to 4 °C) for at least 10 days to 8 weeks for vernalisation and to reach their tillering potential. These cultivars can be planted at very low seeding densities (15 to 30 kg/ha). Spring wheat, like the cultivars planted in the irrigation areas and in the Western Cape, does not require low temperatures, but will not be damaged by low temperatures and frost during the early growth stages. Tillering in spring oats will be lower than in winter types, and therefore much higher seeding rates (80 to 120 kg/ha) are needed in these production areas. However, all small grains are sensitive to frost in the reproductive stage (when the growth points are above ground) or after ear emergence. Frost during this time (usually in September and October) can cause severe damage to the crop. Small grains can also be damaged by dry, warm periods. Heat stress is caused when drought conditions are experienced and is usually associated with high temperatures and warm, dry winds. Heat stress can be particularly damaging during the flowering stage of the plant.

Rainfall

As small grains need moisture during winter, spring and early summer, it is important that water be provided to the crop during this period. In the winter rainfall region of South Africa (e.g. Western Cape Province) sufficient rainfall is usually received during the winter months to provide in the needs of the crop. In the other regions, very little rain is received during winter. Good moisture conservation or 300 mm water over the growth period is required.

Soil requirements

Although oats are widely adapted to moist soil conditions, they have generally similar soil requirements to wheat with regard to both macronutrients

and micronutrients (Fe, Cu, Zn, Mn and Mo) that have a major influence on production. Soil acidity levels of pH 4, 8 to 5, 5 (KCl) are regarded as optimal. Oats are more acid tolerant (up to 15 % acid saturation) than wheat, but less saline tolerant than wheat and barley.

CULTIVATION PRACTICES

Propagation

Oats is propagated by seed.

Soil preparation

Irrespective of the crop rotation system followed, the main aim is to accumulate the maximum quantity of soil water, alleviate compacted soil layers, and prepare a seedbed that will ensure good germination and seedling establishment.

Field layout and design

In general, small grains require a well-prepared seedbed to ensure optimal emergence and development of the crop. A well-prepared seedbed will be level and without growing weeds to give the young seedling a chance

to grow and develop without competition. A seedbed can be prepared by conventional tillage methods where the field is worked with various implements prior to planting. Conservation tillage methods aim to retain stubble on the soil surface and the soil is not ploughed.

Planting

Preceding the planting of oats, the standard seed treatments against seedborne diseases must be applied in grain production, while it is optional in grazing and hay production. The planting time for oats is from September to October in cooler areas and January to April in warmer areas. For hay production under irrigation, the cultivars Maluti, Witteberg, Drakensberg and SWK 001 can be planted from March to June and Kompasberg, SSH 421, SSH 405 and SSH 491 can be planted from May to June. Thanks to the wide adaptability, nutritional value and regrowth characteristics of oats, grazing is available over a long period. Planting for this purpose can start in February and continue up to July. Contact experts for further information in this regard.

Row spacing

Planting activities of oats are similar to those of wheat with regard to depth and row widths used. The required depth for seeding is 2 cm to 5 cm. The spacing in the row is about 30 cm and 50 cm to 100 cm between the rows, depending on the available soil moisture or the farming method (narrow rows under irrigation and wide under dryland).

Seed placement

When a planter is used, the seed is usually placed 2 cm to 4 cm below the soil surface. Under irrigation, seed placement is not as critical as moisture from the surface will be available for the germination process. In dryland production areas, seed placement is very critical because seed must be placed within the moist soil layer. Seed placed above this layer or too deep will not germinate or will not reach the surface.

Fertiliser placement

Fertiliser placed directly with the seed can damage the young seedling and this is called fertiliser burn. It can affect the development of the seedling by temporarily or permanently damaging the roots. In the most severe cases, it may result in die-off. It mostly happens when a dry period occurs after

planting. For this reason, most planters have the ability to place fertiliser separately from the seed. If this is the case, placing the fertiliser 2 cm to 3 cm next to, or below the seed, is ideal. When planters that cannot do this are used, care must be taken not to place too much fertiliser with the seed. As a guideline not more than 15 kg of the nitrogen component of the total fertiliser should be placed directly with the seed. For example, if 30 kg N per hectare has to be applied, only half of this can be placed directly with the seed. The other half must then be broadcasted beforehand and worked into the soil during the final seedbed preparation. Alternatively, it can be applied as topdressing three to four weeks after planting.

Seeding rate

The seeding density for dryland plantings is 20 to 25 kg/ha. The planting spectrum is based on available data; planting outside this spectrum is at the farmer's own risk. For hay production under irrigation, the cultivars Maluti, Witteberg, Drakensberg and SWK 001 can be planted at a seeding density of 40 to 50 kg/ha while the Kompasberg, SSH 421, SSH 405 and SSH 491 can be planted at a density of 70 to 100 kg/ha.

Fertilisation

The nitrogen management of the oats crop is determined by soil and nutrient management strategies, including the previous crop (type), soil water availability, soil nitrogen availability, yield potential, risk of lodging, timing of nitrogen applications and nitrogen sources available for use. For hay production under irrigation, 100 kg N per hectare is recommended, with an additional 25 to 50 kg/ha after each grazing and/or fodder harvest, depending on level of production. For grain production the general recommendation per hectare is 90 kg N per 25 kg P and 20 kg K for a grain yield potential of 4,5 t/ha. The general guideline is 20 kg N per ton of grain for soils with low organic carbon content. For soils with a high-quality residue available for utilisation, 30 kg N per ton of grain yield potential must be applied. Phosphorus is vital for establishment, especially early in the growth season, while sufficiently available potassium can reduce lodging and ensure uniform ripening.

Under dryland conditions in the high-rainfall regions, the recommendation per hectare is 40 kg N, 10 kg P and 10 kg K (optional). A maximum of 20 kg N per hectare or a total of 50 kg N and K per hectare can be seed-placed safely, and higher applications must be band-placed away from the seed. The phosphorus fertiliser recommendations (kg P per hectare) at the yield potential levels and soil analysis value (mg/kg P-Bray 1), as well as the po-

tassium fertiliser recommendations (kg K per hectare) at the relevant yield potential levels and soil potassium analysis value (mg/kg K) currently used for dryland wheat production can also be applied for oats production. Keep in mind that the yield potential of oats is lower than that of wheat under both dryland and irrigation. The same fertiliser recommendations can be used for grazing establishment, with the option of additional N applications after grazing events combined with rainfall occurrence.

Irrigation

Under movable irrigation systems and supplemental irrigation applications, the current recommendation is five irrigations during the growth season if production is started on a full soil profile. These irrigations are applied at the 5-leaf, early stem elongation, flag-leaf, flowering and during the grain-filling stages.

Under centre pivot irrigation systems, an irrigation management programme similar to wheat is used. Irrigation during the later growth stages tends to disrupt uniform ripening, thereby delaying harvesting. Like the other small grains, oats are susceptible to high temperatures and water stress during grain filling and these necessitate well-timed and effective soil water management.

Weed control

Weed control is important in obtaining maximum yields. Broadleaf weeds can be controlled easily with the recommended quantities of appropriate herbicides. Because oats are often used as nurse crops for establishing small-seeded legumes, it is important that the herbicides should be chosen with this in mind. Weeds can reduce yields and the quality of the crop. Weed seeds that cannot be cleaned out and are considered foreign matter causing downgrading are: other cereal crops, grains other than cereal crops and wild oats. There are no herbicides available for controlling wild oats. There are various herbicides registered for the control of broadleaf weeds. Some of these herbicides are registered only for use in the winter rainfall area. It is important always to refer to: "*A guide to the use of herbicides*," to check if a certain herbicide is registered for use on oats. Also remember that smaller weeds are easier to control than bigger weeds. However, the recommended leaf stage for herbicide application must always be taken into consideration. Always use the proper crop rotations and cultural strategies to ensure that oats are planted on fields free of these weeds. Other measures that should be taken when controlling weeds are these:

- Carefully read the instructions on the label before spraying.
- Spray the herbicide at the correct leaf stage.
- Make sure the calibration of the sprayer was done correctly.
- Check that the environmental conditions are favourable for spraying, (e.g. no wind or rain).
- The person spraying the crops should always be wearing protective clothing.

Pest control

Pests in the winter rainfall region

Aphids

Aphid species causing problems in the winter rainfall area are mainly oat aphid, English grain aphid and grain-rose aphid. Russian wheat aphid, which is the most severe wheat aphid in South Africa, 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.

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 mature) larvae are generally less susceptible to insecticides and obviously cause greater damage than small larvae do. Chemical intervention can be considered when five to eight larvae are present per square metre. However, producers should take care to apply 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 are less able to tolerate/recover from chinch bug damage. There are no insecticides.

Grain slug

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

Black sand mite or red-legged 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

Pests include 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 owing to sap-feeding and later yellow or bronze, resulting in yellow or brown patches	Chemical control

Pest	Symptoms	Control measure/s
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 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

Disease control

Oats are susceptible to crown and stem rust and to "barley yellow dwarf virus," which is spread by aphid infestations. It is economically viable to control diseases at yield potential levels above 4 t/ha. Diseases generally lower the kernel weight and hectolitre mass, leading to grain discolouration and downgrading of the product, as well as a lower price per ton of grain.

Diseases of small grains in the winter rainfall regions

Disease group	Disease	Symptoms	Control
Rusts	Stem rust	Big parts of the stem appear red-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 with 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
Stem base and root	Take-all	Infected plants ripen prematurely and are stunted, die prematurely	Crop rotation. Volunteer plants, grassy weeds and crop residue should be destroyed
	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

Diseases in the summer rainfall region

VIRUS DISEASE

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.

Active ingredients of fungicides registered for the control of seed-borne diseases of small grains

Active ingredient	**Seed-borne disease**	
	Loose smut oats	Covered smut oats
Carbonxin/Thiram		
Mancozeb		
Tebuconazole		
Thiram	X	X
Triadimefon		
Triadimenol	X	X
Triticonazole		

Harvesting methods and maturity

Oats can be harvested at grain moisture content below 20 %. Shattering in the field can be a problem and rain during harvesting can result in kernel discolouration and consequent downgrading of the crop. Normally a commercial harvester is used to harvest the crop, especially when a large number of hectares have been planted. The table of the harvester can vary from 3 m to 10 m, depending on the area planted. To obtain a higher quality, dehulled kernels must be avoided. This may involve slower cylinder speed and wider concave clearances.

Hulless oats are vulnerable to damage. Thresher cylinder speed should be reduced to approximately 900 rpm and the concaves should be carefully adjusted to avoid damage. Plot harvesters/combines are used for trials with small plots. Very small areas are harvested in the traditional way, that is, with the use of sickles.

POST-HARVEST HANDLING

Cleaning and sieving

There are various options (including cleaning and sieving) to improve grain quality parameters, especially hectolitre mass, to obtain better prices per ton of grain.

Grading

The grading of oats was deregulated in South Africa at the end of the nineties and it is now based on the specifications determined by the buyer. The main “grading factor” is hectolitre mass. Large and well-filled groats/kernels are in high demand by the processors and hectolitre mass is an indication of this aspect of quality.

Just as in the case of wheat and barley, hectolitre mass of oats is determined during the grain-filling stage. Abnormal leaf senescence prior to or during flowering and grain filling because of malnutrition, diseases or stress will cause low hectolitre mass. The deficiencies must be corrected before the flag-leaf stage to ensure a positive effect on hectolitre mass.

Grading requirements for oats

Grade	Minimum hectolitre mass
Grade 1	53
Grade 2	48
Feed grade	38

Storage

Oats can only be stored safely at a grain moisture below 12,5 %, or alternatively it can/should be delivered to the buyer as soon as possible to secure the investment. This is the safest and easiest, as the storage of grain can be problematic, especially if the necessary infrastructure is not available.

Damage that can occur during storage under too wet or hot conditions includes the following:

- Grain may turn mouldy. Developing fungi produce mycotoxins that could prove to be toxic and make the grain unfit for human or animal consumption.
- Grain may start germinating or become heat-damaged.
- Grain may become infested with damaging insects. Wet grain is far more susceptible to insect infestation than dry grain because insects need warm, moist conditions to survive and reproduce. Insect-infested grain may acquire a bad taste and odour.

Grain can be stored in concrete or galvanised iron silos. The capacity of these silos can vary from under 1 000 tons to 5 000 tons. Grain can also be stored in silo bags with a capacity of about 180 tons, depending on the type of grain stored. The precautions and recommendations always have

to be followed very strictly. Grain can also be stored in bags, for instance 25 kg, 50 kg or 80 kg each. The bags should be packed on poles to avoid dampening by the floor.

Rodents damage the bags and eat the grain, causing huge losses and pollution of the grain. Grain insects must be controlled by fumigation with phosphate gas and rodents with poison in pellet or liquid form. Only chemicals/insecticides registered for that specific grain may be sprayed on the grain to control insects.

Marketing

There are various options, e.g. cleaning and sieving, to improve grain quality parameters, especially hectolitre mass, to attain better prices per ton of grain. Oats are marketed along free-market principles. Oats can therefore be sold to whoever pays the price required, provided the oats comply with all the specifications of the buyer. Matters such as transport, quantity, where, when and in what form the grain will be (mass or packed in bags) must all be stipulated in an agreement/contract. The needs of the buyer as well as the seller must be negotiated and met.

Processing

During processing the grain is sieved into different class sizes. This process is done very accurately, as an important quality aspect of the end product is the effectiveness of the sieving process. The largest seeds are more desirable, while the smallest grains are generally worthless. Uniform seed size is therefore ideal. As the largest seeds ripen first and tend to fall out first, it is important not to delay harvesting.

Twin oat grains often occur. This characteristic is cultivar-specific but can also be the result of environmental conditions and the harvesting process. Twin oats are undesirable as they go through the sieving process as large seeds and are later separated as two small oat grains that cannot be dehulled. The harvester must therefore be set in such a way that a minimum of twin oat grains are harvested. Naked oat grains are grains of which the hulls have been removed in the harvesting process and are totally undesirable as they are separated into the small and medium-seed sizes in the sieving process and are then ground, not dehulled in the dehulling process. The adjustment of the harvester is therefore critical and requires special and specific attention by the producer.

PRODUCTION SCHEDULES

Activities	January	February	March	April	May	June	July	August	September	October	November	December
Soil sampling	■	■	■									
Soil preparation	■	■	■	■								
Planting					■	■	■					
Fertilisation				■	■	■			■	■		
Irrigation						■	■	■	■	■	■	
Pest control					■	■	■	■	■	■		
Disease control					■	■	■	■	■	■		
Weed control								■	■	■		
Harvesting	■										■	■
Marketing	■	■	■	■								

UTILISATION

Oats are grown for grain, forage, fodder, straw, bedding, hay, silage and chaff. Food uses include oatmeal, oat flour, oat bran and oat flakes.

Oats are among the most nutritious cereals, high in protein and fibre. The protein of rolled oats is generally greater than that of other cereals. Many of the vitamins and minerals in oats are in the bran and germ, and most oat food products use the entire groat.

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