WHEAT PRODUCTION GUIDELINE

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Ministry of Agriculture and Food Security: Department of Agricultural Research, BOX 829, Maseru 100, Tel: 266 22312395.

Introduction

Wheat belongs to the family *Gramineae*, tribe *hordeae*, genus Triticum and its specific origion is still unknown. It is an annual grass made up of roots, stems with tillers, leaves, inflorescence and seeds. It is the most important winter crop in Lesotho and a staple food in the mountain areas of Lesotho where other cereals like maize and sorghum are less adapted to lower temperatures and mainly planted for commercial purposes in the Lowlands to supply among others large companies including Lesotho Floor Mills. Lesotho imports about 115 000 metric tons of wheat annually from South Africa.

PRODUCTION SCHEDULE

Activity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Soil sampling		↔	↔	↔								
Soil preparation			↔	↔								
Planting (lowlands)					↔	↔						
Planting (Highlands)									↔	↔		
Fertilization			↔	↔	↔	↔						
Harvesting (Winter)		↔										
Harvesting (summer)			↔	↔								

Soil sampling for analysis

Crop productivity in general is low in Lesotho as a result of the long cropping history of low manure and fertilizer inputs coupled with the low nutrient status of the soils, which can no longer support most of the crops. In order to improve the productivity, all soil chemical limitations can be determined effectively by soil sampling and laboratory analyses for nutrients. Sampling should be done 2 months before planting. The following are the important aspects to consider during soil sampling;

- If a field consists of more than one soil form, a soil sample should be taken from each soil form.
- One representative sample for every 50 ha should be sufficient. A soil sample must represent a homogeneous unit of not more than 50 ha.
- Each sample should consist of at least 20 sub-samples taken randomly throughout the land unit or soil form.
- Sub-samples should be properly mixed before a representative sample is taken.
- Top soil samples are taken from 0 – 200 mm and sub soil samples from 200 – 600 mm.
- When taking the sample, all foreign matter (grass, twigs, and loose stones) must be removed at the sampling point. In the case of very rocky soils an estimate must be made of the rock percentage per volume.
- Farmers are warned against using salt bags, fertilizer bags or other contaminated containers. Clods must be crushed, foreign matter removed, and the soil must be mixed thoroughly. After spreading the soil in a thin layer, small scoops are taken evenly over the whole depth and area and placed in a clean plastic bag or carton.
- The reliability of a soil analysis depends on how representatively the soil samples were taken in the field.

Soil acidity

One of the major wheat production problems in the summer rainfall region is the increased acidification of soils, especially in the northern lowlands and foothills of the country. The negative effect of acid soil lies in the high level of free aluminium ions, when compared to other cation levels, in the soil. When the root system of the young plant is exposed to high aluminium levels, severe drought and nutrient stress symptoms appear and plant mortality may eventually occur. The symptoms of aluminium toxicity are clearly visible on the roots. The root tips become thickened, the lateral roots brittle and a brown discoloration take place. The pH $_{(KCl)}$ and soil texture is used to determine the lime requirements for wheat. Soil analysis for lime requirement purposes is essential when the soil pH $_{(H2O)}$ below 5.5.

The application of lime

Liming material must comply with certain specifications of fineness and reactivity for the effective neutralizing of acid soils. Dolomitic agricultural lime must contain more than 20% magnesium carbonate ($MgCO_3$) and calcitic agricultural lime more than 70% calcium carbonate ($CaCO_3$). Lime must have a fineness of less than 250 micron. It is essential that lime be applied three to four months before planting. When dry soils are limed only a small change in the pH values will be obtained. Acidification is more rapid in light textured soils than in the clayey soils because of their differences in buffer capacity. Light textured soils have lower lime requirements to attain certain soil pH levels. It is essential to remember that a good reaction will only be obtained when the lime is well mixed with the soil. Lime has to be mixed into the soil with a disc, and then ploughed in to a depth of 200 mm to 400 mm.

Climate

Winter wheat require very low soil temperatures (3-4°C) for at least 10 days to 8 weeks in order to vernalise and reach their tillering potential. Almost all cultivars are susceptible to preharvest sprouting (germination of seed in the ear) and must be harvested as soon as possible to prevent low falling number or sprouting of the crop. Wheat that is not harvested in time can quickly deteriorate in terms of quality and become infected with fungi (mould), indicated by a change of colour in the ears (golden yellow to white to black).

Soil requirements

Wheat is in general well adapted to different soil types and can therefore be grown on all arable soils in Lesotho including heavy clay soils and very sandy soils as long as the climatic requirements are met. As with any other crop, wheat thrive in fertile well-drained soils, but with good fertilisation programmes even less fertile soils can be productive. Wheat is however more sensitive to soil acidity than most crops and require a soil pH_{water} of at least 5.5 and an acid saturation of less than 8%. For increased rainfall efficiency, special soils with a large water holding capacity are needed to ensure sufficient soil water storage. These soils must be able to store at least 180mm water before planting and mostly consist of the duplex soil types. Soil types with aquic moisture regime such as Sephula series, Majara series, Rama series have a heavy clay layer or barrier layer that prevents stored water from

draining away, and are therefore suitable for soil water storage. Very well drained soils like the Leribe series (deep red soils) are also suitable but require good rainfall.

Seed and sowing (Planting)

The optimum time for sowing is determined by several factors, most important of which are temperature and moisture during growing season. Wheat needs chilling temperatures for vernalisation. Sowing commences from late April to June for the lowlands winter growing season and in September to October for the highlands summer growing season. Seeding rate ranges from 20 – 25 kg/ha. The inter-row and intra-row spacing are 40 – 50 cm and 7 – 15 cm respectively, when using a planter. Seed should be placed 5 cm deep. Always use treated seed for the control of soil-borne fungal diseases.

Cultivar choice

Cultivar choice is an important production decision and if correctly planned, could greatly contribute to reducing risk and optimizing yields. Whereas the latter is an important determining factor, yield potential coupled with nutrition and high baking quality have more market opportunities. Hence recommended for commercial purposes of which the Lesotho milling company is the key client. The following varieties released in South Africa are available in the market but have not been tested for performance by the station; SST 124, SST 319, SST 322, SST 333, SST 347.

The station is currently testing seven sets of germplasm of which four sets were provided by International Center for Agricultural Research in Dry Areas (ICARDA) and three other experimental sets were provided by International Maize and Wheat Improvement Center (CIMMYT). The purpose is to come up with the most appropriate varieties that will contribute to variety release in the country. Currently most of the varieties in the seed market are South African released and there is a need for Lesotho to produce cultivars of her choice. The local varieties released by DAR (**Tugela DN, Karee, Scheepers, and Flamink)** are old and are no longer available in the market as most of them have lost their purity and probably vigour.

However, they were good varieties which tolerated drought and birds and were early maturing with good hectolitre mass.

Fertilizer application

Wheat plant requires adequate nutrients to grow and produce high yield of good quality. Nutrients critical for the growth and development of wheat are nitrogen, phosphorus and potassium. However, high levels of nitrogen cause severe lodging in tall cultivars; while low levels cause yellowing of the leaves and stunted growth. Nitrogen is responsible for the deep green colour of the leaves. Phosphorus in inadequate amount shows purple leaves and retarded root development. It is responsible for root proliferation. Nitrogen required by wheat per hectare is 40 – 60 kg. Phosphorus requirement is 12 – 15 kg P/ha. It is advisable to take soil samples every three years and send it to a soil laboratory for determination of various nutrients in the soil obtained from the farmer's field. The results will show as to how much nutrients have to be supplemented to meet the crop requirement.

Pest and disease control

A variety of insects with different feeding habits are found on wheat. Important ones are aphids, bollworm, grain stink bug and red legged earth mite.

Aphids

Aphids prefer thick plant densities with damp conditions. Chemical control can be applied when 70% ears are infested with 5 – 10 aphids per ear for the control of the aphids. Malathion 25% WP in 5 liters of water or Metasystox 20 ml per 20 liters of water can be used to control Aphids.

Grain stink bug

Grain stink bugs are sap feeders and measure 4 – 5 mm in length. The eggs are laid in rows of up to 150 on the leaf sheaths and the young wingless nymphs with yellow to orange coloration appear during spring. Both nymphs and adults feed by sucking sap from the plant leading to slightly yellow, withered appearance. Sap may also be sucked from the seed. Damage is more pronounced under warm, dry conditions as stressed plants have less ability to tolerate/recover from bug damage. During early

summer adults migrate to alternate host plants where they over-summer before re-infesting the wheat crop during winter. These are small black mites, 0.5 mm in length with red legs, first appearing after good autumn or winter rains. The mites feed on plant sap resulting in silvery white scars adjacent to the main vein of especially older leaves. High infestations could lead to dying off of small plants. The mites over summer in eggs retained by the female inside her body until after her death. Bulldock with 20 ml per 20 liters of water can be used.

Wheat is susceptible to various diseases such as ***leaf rust, stem rust, powdery mildew, and smut***.

Leaf rust is caused by *Puccinia recondita* f.sp. *tritici*. The circular or elliptical pustules are orange-red to orange-brown in colour and occur on the leaf surfaces. The pustules are smaller than those of stem rust. Initially the leaves are green but as the pustules form, the leaves turn necrotic and brown in colour. Dithane 80% WP in 5 liters of water can be used to control leaf and stem rust.

Stem rust caused by *Puccinia graminis*. f.sp. *tritici*, also known as black rust, is an obligated parasite and can only grow on living host material. Symptoms include raised oval shaped, dark reddish-brown pustules that will occur on the stems of the plants. Optimum temperatures for spore germination range between 15 – 24°C. Stem rust is more prevalent later in the growing season with hot and humid weather further promoting disease incidence. Early infections will reduce the amount of tillers and result in losses in grain weight and quality. Dithane 80% WP in 5 liters of water can be used to control leaf and stem rust.

Smut is caused by *Ustilago tritici*, occurs wherever wheat is grown. Typical symptoms of this disease can only be seen after head emergence. On infected heads, masses of dark brown spores will replace the grain. These spores will be blown away and only the bare rachis will remain. Spores will infect the healthy heads, become dormant and in the following year this disease will re-emerge. Disease development is favoured by cool, humid conditions that will prolong the flowering period of the plant. To prevent loose smut, it is recommended that

chemical seed treatments be used. In addition, it is advised that producers make use of certified seed only.

Harvesting

The wheat crop ripens 30 days after the blooming of florets. The kernels are completely filled when they reach the dough stage. At that time the leaves, stalks and spike begin to lose their green colour and become golden yellow. Wheat crop reaches physiological maturity between 35 to 45 percent moisture content, but it needs to dry down to safer moisture content for harvesting and storage. The seed moisture content can be used as an indicator of when the crop is ready for harvest. Average kernel moisture at which wheat can be stored is 10 – 12%. On small farms hand-cutting using sickles is popular. The most critical factors for storage to be considered are seed moisture content, mechanical damage and cleanliness of equipment.

Storage

Produce should be harvested when physiological maturity is reached, dried to safe moisture content of 10 – 12%, stored under favourable conditions and protected from damage and pests until it is sold. The produce should be kept dry and cool in clean stores. When the produce is dry and cool, physiological processes, fungal activity and insect activity are low. The following are the conditions that need to be taken into consideration when storing wheat crop:

(a) Immature or damaged seed cannot survive long storage periods. Seed should be harvested when properly matured.
(b) Mechanical injury to seed during harvesting or handling makes it more susceptible to deterioration in storage.
(c) Seed should be properly dried before going into storage and protected from moisture and high relative humidity.
(d) High storage temperature has a damaging effect on seed. Store facilities should be designed so that low temperatures are maintained.
(e) Rodents, particularly, rats and mice, can be most destructive to the produce. Effective rodenticides are used. A complete programme of exclusion, sanitation and control should be in place.

(f) Insects should be controlled by a combination of insecticides and fumigants. Phostoxin is the safest, while methyl bromide may affect the produce.