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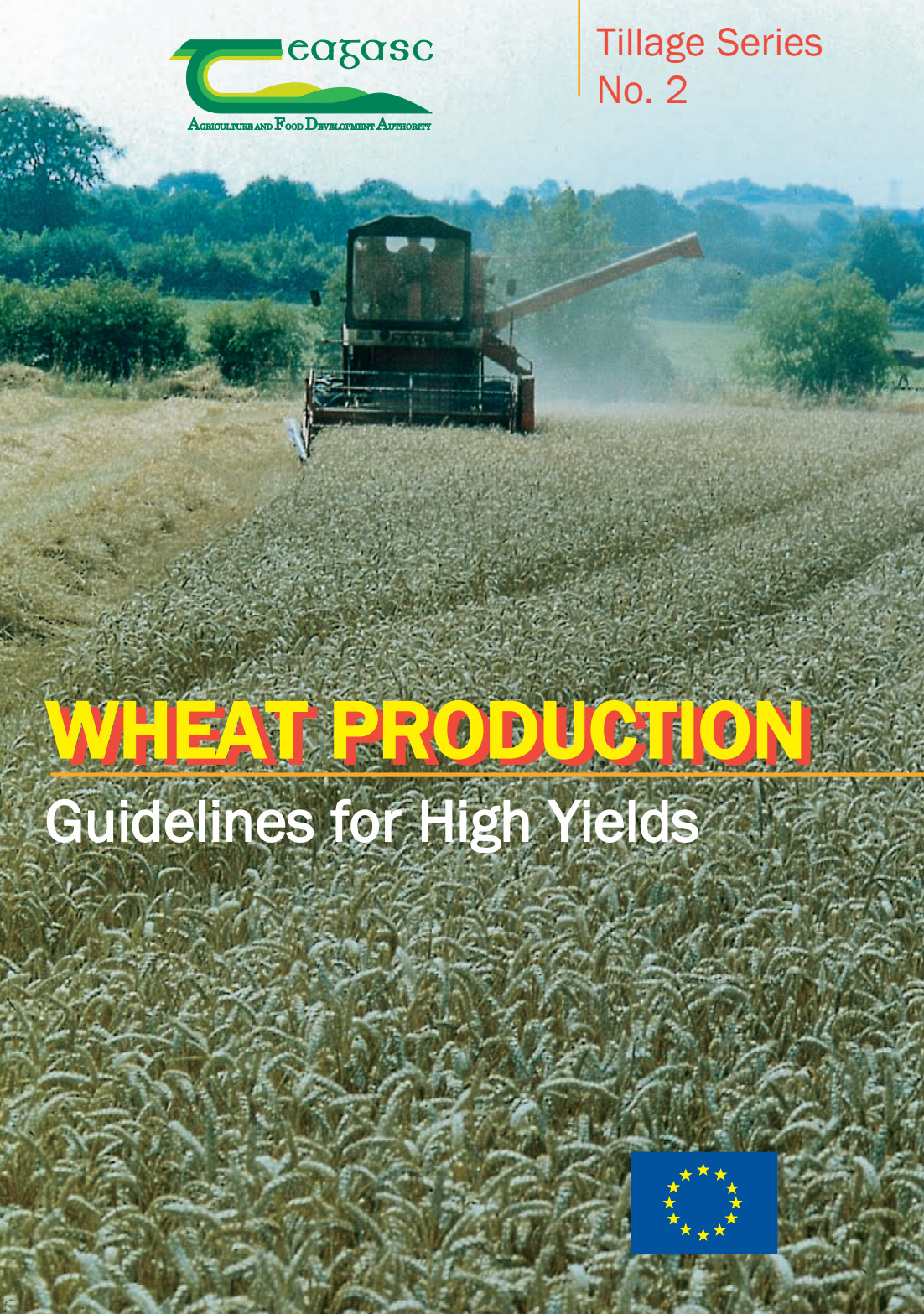

WHEAT PRODUCTION

Guidelines for High Yields

WHEAT PRODUCTION

In recent years, the area of winter wheat has ranged from 50,000 to 60,000 ha. with spring wheat occupying from 17,000 - 24,000 ha. The main reason for the dominance of the winter crop is the higher output and margins obtained in comparison to spring sown varieties.

Market Requirement

The main outlet for feed wheat is pig and poultry rations and there is currently a demand for over 600,000 tonnes of feed wheat from the compounding industry.

A total of 260,000 tonnes of wheat is required to meet the annual consumption of flour in Ireland. Wheat for household and biscuit flour, soft wheat with lower protein, accounts for 100,000 tonnes of this total and can be easily obtained from current winter varieties. Flour imports from the U.K. now displace the equivalent of 50,000 tonnes of wheat. Therefore the present market for quality bread making wheat is in the order of 100,000 tonnes. Spring varieties are more suited than winter to supply this market.

Specification

The main quality criteria for feed wheat is specific weight. A standard of 72 KPH (Killogrammes per Hectolitre) is required by all compounders.

In addition, to the standards listed, wheat must be sweet and sound and free from obnoxious impurities. It must not have overheated either before, during or after drying.

Millers wheat requirements vary depending on their customers flour requirements. A hard wheat with high protein content is required for bread making flour while less demanding standards are set for household and biscuit flours. (See Table 1)

TABLE 1: WHEAT SPECIFICATIONS FOR VARIOUS USES

	Bread making	Household Flour & Wheatmeal	Biscuit	Feed
Protein (at 15% M.C)	10.5%(min)	9.5%(min)	10% (max)	
Min. Hagberg (Falling No.)	250 —	200 —	200	
Min. Spec. Weight KPH	70	70	70	72
Hardness	> 0	0	< 0	
Max. Moisture (if artificially dried)	15%	15%	15%	

Protein

The term protein embraces a large number of nitrogen containing compounds concentrated in the endosperm (flour portion) and germ (embryo) of the grain. The endosperm contains almost 80% of the total protein. These proteins are formed during grain filling and their final level can be influenced by husbandry. As protein is inversely related to yield, it is difficult to get high proteins from very high yielding crops.

In baking terms protein quality refers to the physical characteristics of the gluten protein, in particular its elasticity, strength and toughness. As protein quality is totally determined by variety, quality is generally assured by purchasing only acceptable nominated varieties. Protein quality can however be adversely affected if overheating occurs during storage or drying. Denatured or discoloured gluten can be detected at intake points by a gluten washing test.

Hagberg Falling Number (H.F.N.)

The Hagberg test is used to measure the level of enzyme activity in the grain. This enzyme (Alpha Amylase) degrades starch to sugars and dextrins and renders the flour unsuitable for baking. Flour from grain with high amylase activity produces an excessively dark, coarse textured loaf with sticky crumb and poor slicing quality. All wheats contain some alpha amylase with some varieties having unacceptably high levels. The levels however, even in varieties with inherently low levels, will quickly become excessive when sprouting is initiated as happens when mature wheat is exposed to weathering.

The enzyme once present cannot be inactivated or reduced during subsequent handling. High Hagberg readings indicate low enzyme levels. Choosing a variety with high H.F.N. and good resistance to sprouting, together with prompt harvesting and drying will all combine to minimise Alpha Amylase levels.

Specific Weight (Hectolitre Weight)

This is the weight of a given volume of grain expressed in KPH. Within varieties, it is a reasonable indicator of grain fill. Wheats with high specific weights, plump grains with dense endosperm, will have a high potential yield of extractable flour. Specific weight is also dependent on the packing ability of the grain and as varieties differ in shape, size and smoothness their specific weights will tend to fall into different bands. Crops grown under husbandry and climatic conditions that produce maximum yield will give grain of high specific weights. Factors such as disease, drought, lodging, premature harvesting or poor cleaning of sample will reduce specific weight.

Hardness

Grain hardness is an important determinant of the ease with which grain can be milled. Hardness has two important advantages. Firstly flour from hard grain will flow easily through milling and sieving machinery giving easy separation from bran. This ensures high flour extraction and good flour colour. Secondly, flour from hard wheat has higher water absorption which improves the crumb structure and shelf life of the finished loaf.

PRODUCTION

Soils & Climate

Wheat is best suited to medium to heavy soils. Very heavy soils may be too difficult to cultivate for timely sowing. Low rainfall and high levels of sunshine during grain filling and ripening are the ideal conditions for high quality grain.

Rotation

Take-all is the major constraint on growing wheat in a rotation. For this reason wheat should not be grown from the third to the sixth year after lea or from the second to the fourth year after a break crop, such as roots, potatoes or peas. With these exceptions wheat can be grown continuously on suitable soils out in the rotation.

Oats and rye are resistant to the common strain of Take-all and so are ideal “cereal break crops” for wheat.

Bread wheats should ideally follow nitrogen generating crops such as grass/clover leys or pulses. It can however be also grown after other breaks such as roots, potatoes, oats and oilseeds

Varieties

The correct choice of variety is important because the additional yield or higher quality produced by the best varieties can increase the value of the output for little or no extra cost. Furthermore, disease resistance, strength and length of straw,

etc. can have a major influence on the most appropriate production methods and consequently on profitability. By knowing the strong and weak points of a variety you can exploit it to the full and treat it to overcome its weaknesses.
Flour for bread making can be produced from winter or spring varieties of wheat. Selection of varieties must be confined to those wheats that are acceptable to millers. When choosing a variety, do not over concentrate on its yielding ability. Careful consideration must be given to the main factors that influence quality i.e. resistance to lodging, disease, sprouting, grain protein content, Hagberg Falling Number and earliness of ripening. Choose varieties from the most up to date 'Recommended List' produced annually by the Dept. of Agriculture & Food.

Cultivations

A fine firm seedbed produced with a minimum of passes is ideal for quick even germination. For late Autumn sowing it is advisable to till and sow directly after ploughing. For spring sowing, early ploughing will reduce the cost of subsequent cultivations and improve the seed bed quality.

Yields from direct drilled winter crops are similar to conventionally sown crops provided that the associated husbandry is very good. When direct drilling all debris should be removed and 30 kg/ha (24 units/acre) of N applied at sowing. Grassweeds are likely to be more of a problem in direct drilled crops, unless a high standard of management is applied.

Sowing Dates & Seeding Rates

For maximum yield, winter varieties should be sown from the end of September to early November. Potential yield will decline gradually and harvesting is delayed with late November or early December sowings. Modern spring varieties can be sown from mid-October to end of March. Late Autumn sown spring varieties can rival winter varieties in yield. In practice sowing either winter or spring varieties from mid-December to mid-January is usually difficult with slow establishment and poor plant stands. Apart from an increased risk of lodging, spring varieties sown in the Autumn can be treated as winter varieties.

The recommended seed rates for autumn sowing is 155 - 204 kgs/ha. (10 - 13 st/ac.) The higher seed rate is used for late sowing in difficult conditions.

The recommended seed rate for spring sowing is 140 - 188 Kgs/ha. (9 - 12 st/ac.) Field conditions should be the main criteria when deciding within this range.

Crop Structure

The three components of yield in any cereal crop are the:

- Number of ear-bearing tillers per unit area (ears/M^2);
- Number of grains per ear;
- Grain size (1,000 grain weight).

There is good scope for compensation between the three components. Thus, in a crop with a lower than optimum number of ears/M^2, the number of grains per ear or the size of the grain may compensate. However, there is a limit to the amount of compensation that can take place and it is necessary to set minimum targets for ears/M^2 so that the crop has the potential to yield well even under unfavourable conditions.

The target number of plants/M^2 at establishment is 200-300. This plant density should ideally produce 500-600 ears/M^2. The recommended seeding rates are more than adequate to meet these targets under most conditions. The minimum acceptable plant stand is about 80 plants/M^2 provided they are evenly distributed.

The application of high rates of nitrogen can increase the number of ear-bearing tillers from a low plant stand. Some modern semi-dwarf varieties have a remarkable capacity to produce very large ears from low ear counts.

Lime

The ideal soil ph is 6.5 - 7.0. When lime requirement exceeds 2.5 T/ha yield reduction is likely.

NUTRITION

Nitrogen

For maximum yield and quality an adequate supply of nitrogen must be continually available to the crop. In the absence of a reliable nitrogen test the amount the soil will supply must be estimated. The factors to be considered in addition to nitrogen index (See Table 2) are soil type, rainfall, strength of straw and crop vigour. The most important factor is cropping history and this, as can be seen from the index, is the basis for the recommendation. The rates outlined are all based on average conditions. Where any of the other factors are strongly in contention, the rate can be altered by 12 - 15 Kgs/ha for each factor.

N. INDEX	WINTER	SPRING
1. (Small Release of Soil N)	210 (168)	160 (128)
2. (Medium Release of Soil N)	175 (140)	140 (112)
3. (Large Release of Soil N)	140 (112)	100 (80)
4. (Very Large Release of Soil N)	80 (64)	50 (40)

RATE KG/ha	END FEB./	END MARCH /	LATE APRIL
< 75	—	All	—
75 - 150	1/3	2/3	—
150+	1/4	1/2	1/4

Spring Crops

On spring sown crops up to 75kgs N/ha can be drilled with the crop and the remainder applied at growth stage 25 - 30. On February/early March, drilled crops, seedbed nitrogen should not exceed 35kg N/ha.

Nitrogen For Protein

Except in very dry conditions 30 - 40 kgs N/ha should always be applied between flag leaf and ear emergence, G.S. 39 - 49. This will increase protein levels by 0.5% - 1.0% and may also give a small yield increase.

Alternatively, this nitrogen can also be applied at the milky ripe stage as a foliar urea with contentional spray nozzles and applying a 10% N. solution. For a 10% N solution dissolve 1kg urea in 5 lt. water.

Phosphorus & Potassium

A soil test will establish the existing levels of P & K. The recommended rates (See Table 4) will supply the crops requirements without depleting soil fertility levels.

At soil index 1 and 2 the P & K requirements should be applied at sowing time.

Soil P or K Index	P	K	P	K
	Straw ploughed in or burnt		Straw Removed	
1	35 (30)	75 (60)	45 (35)	95 (75)
2	30 (25)	60 (50)	35 (30)	75 (60)
3	20 (15)	40 (30)	25 (20)	60 (40)
4	nil (nil)	nil (nil)	nil (nil)	nil (nil)

Sulphur/Trace Elements

Wheat crops grown in medium to heavy soils are unlikely to be deficient in these elements. Problems are more prevalent in light to medium soils. In known sulphur deficient areas choose a fertilizer that will apply approx. 15 kgs sulphur/ha.

A soil test is essential to clarify the levels of Copper, Manganese and Zinc and apply the appropriate formulation and rate where required.

WEED CONTROL

There are three opportunities to control weeds in Autumn sown cereals.

Pre-Emergence

This option is declining in popularity. Crops are sprayed before emergence and within four to five days of sowing.

Post Emergence (Autumn)

The herbicide is applied after the crop emerges when tramlines are evident but usually before mid December. It is the best approach for early sown weedy crops in heavy soils that may be late to dry out in the spring. The choice of product will depend on the weed spectrum. The cost can be reduced if grass weeds are not a problem.

Post Emergence (Spring)

This is the most sensible approach for crops sown after mid October.

Spring Sown Crops

Ideally weeds should be controlled before crops are fully tillered.

Wild Oats

Wild oats is a serious weed problem that affects both yield and quality of cereals. Low infestations, up to 200 per acre, can be hand rogued. For high levels there is a range of very effective herbicides available.

Scutch

Scutch should be controlled with Glyphosate in the previous crop either pre or post harvest.

PEST CONTROL

Aphids/BYDV

Barley yellow dwarf virus can reduce yields by up to 50% in severely infected crops. The disease is endemic in grassland and is spread to cereals by aphids. Control can only be achieved by controlling the aphids which spread the virus. Crops emerged by early to mid November are at most risk. There is also a risk of infection to emerging seedlings when sown into grassy leas.

Control

Before ploughing grassy leas, burn off with paraquat or glyphosate.

Spray all emerged crops in early - mid November with a contact type aphicide.

Spring Wheat

Crops sown at the recommended time are not at risk.

Aphids at Heading

Aphids can colonize ears of wheat after heading. Apply an aphicide if there is an average of 5 per ear at any time from heading to nearly ripe stage.

Slugs

Slugs are most likely to be a problem after grass or other dense cover crops particularly in heavy soils. Late sown slow emerging crop are at greatest risk.

Fine firm seed beds will limit slug activity. Check seed for hollowing out damage and leaves for shredding. Apply slug pellets where required.

Leatherjackets

Leatherjackets are not a major problem in winter crops but can cause considerable damage in spring crops after lea or grassy stubble. Seedlings and plants up to the tillering stage are cut off at or just below soil level. Spray with Dursban or Gammocol at the early signs of damage.

Wireworms

Wireworms are rarely a problem in winter crops. They can be a threat after lea or second lea in spring crops. Seed dressing gives adequate protection.

Frit-Fly

Frit-fly is not a major pest problem in cereals. The larva burrow into the centre of the stem and kill the central shoot. Chemical control is only effective if applied at the very early signs of damage.

Rabbits

Rabbits are a major pest problem especially in winter crops. Late sown slow growing crops are at greatest risk. Avoid late sowing in small fields. Use all the accepted strategies to reduce numbers before the winter.

Birds

Crows can damage late sown crops particularly where seed is not properly covered. Loss pre harvest is not a problem in standing crops.

DISEASE CONTROL

When growing top quality wheat, one of the most difficult tasks under Irish climatic conditions is the control of foliar and ear diseases. The root disease, Take-all should be avoided with proper rotations. The stem based disease Eyespot can be prevented or controlled by rotations and chemicals. Septoria, the most serious disease problem and Mildew must be controlled by:

- Adopting recognised stubble hygiene procedures.
- Exploiting varietal resistance.
- Implementing a timely fungicide programme based on applications pre and post heading.
- Other diseases such as Rusts, Fusarium, Botrytis are more sporadic in occurrence but can have devastating effects when weather conditions favour their build up. Timing and choice of fungicide may have to be altered to cope with these diseases.

Take-All

Severe infections can cause poor tillering, stunting and early death of plants. The problem can be identified in April by the occurrence of poor patches in the crop. When the roots of these stunted plants are examined after washing they have a very black colour. These stunted patches will be very noticeable after ear emergence and will ripen prematurely. Loss of yields in the bad patches may be up to 70%.

Prevention

- There are currently no fungicides or resistant varieties available for control. However development with seed dressings look very promising.
- Avoid winter wheat in years 3 - 6 after lea and years 2 - 4 after a break crop.
- Control scutch.
- Do not apply lime in years when Take-all could be a problem.
- Have a high nutrient status. Use high levels of nitrogen in suspect crops.

- Avoid very early sowing.

Eyespot

This disease may occur following a cereal or even after a break crop in a cereal rotation. Heavy soils and wet cold springs favour the disease.

The first symptoms are diffuse brown smudges on the outer leaf sheaths at or just above soil level which later develop into the characteristic eye-shaped lesions. The lesion has a pale centre with a diffuse brown margin and sometimes black dots in the centre of the eye.

Severely affected straws exhibit the characteristic diagonal twist or, "struggling" and the risk of lodging is greatly increased. The disease also causes premature ripening giving poorly filled ears which may appear as white heads.

Sharp Eyespot

Sharp eyespot should not be confused with true eyespot. It can be distinguished from eyespot by the fact that:

Sharp eyespot lesions have a distinct dark brown border which is more sharply defined at the margins.

The centre of the lesion is a pale colour on which purplish-brown fungal masses frequently develop. These can be readily scraped off.

Stems often bear multiple lesions, sometimes to a height of 30cms or more above soil level.

This fungus is soil inhabiting and cannot be controlled by rotation. It tends to be more common on light soils and in early sown crops. There is no suitable chemical control but stubble burning is helpful.

Septoria

This is one of the most serious diseases of wheat in Ireland. Yield can be reduced by up to 40% in a severe attack. Two species commonly infect wheat - Septoria Nodorum and Septoria Tritici (Leaf Spot), the latter is the most common up to flowering causing oval chocolate brown lesions. These coalesce to produce the characteristic irregular blotches usually with a sharp yellowish border. Dark coloured spore cases (Pycnidia) in the lesion can usually be seen with a hand lens.

The lesions of Septoria nodorum (Glume Blotch) on the leaf are lens shaped with

pinkish brown pycnidia which are difficult to find. In a severe attack the lesions coalesce to form extensive brown dying areas on the leaf and the glumes of the ear. The spots on the glumes are at first dark brown but later become purplish-brown developing buff centres as the ears ripen. Septoria is favoured by wet weather.

Control

- Good stubble hygiene including burial of debris is very important.
- In high risk areas make maximum use of varietal resistance.
- Planned fungicide programme based on applications at 3 - 4 week intervals between growth stage 32 - 39 and again at growth stage 59.

Mildew

Mildew occurs as a whitish grey mass on leaves, stems and ears of wheat. It is favoured by warm dry weather and consequently is more likely to be a problem in the summer at the later stages of growth of the crop. However autumn and spring attacks can sometimes be severe.

Control

Good stubble hygiene is helpful.

Choose resistant varieties and make use of the varietal diversification scheme, where available, to reduce spread from one crop to another.

Plan a fungicide programme based on the risks of attack.

For further information on diseases and their control, consult your Teagasc advisor.

Rusts

Both yellow and brown rust can occasionally cause serious losses. Fungicide choices may have to be altered to cater for these diseases. Consult your Teagasc Advisor for specific details.

Fusarium

Is a serious threat if prolonged wet humid weather occurs from flowering onwards. It is the only disease that cannot be adequately controlled or prevented with fungicides.

Chemical treatment is only of limited use and the application must be made during flowering. Choosing varieties with good resistance to the disease is the only way to reduce the risk of heavy losses in problem seasons.

GROWTH REGULATORS

One of the pre-requisites for grain quality is a standing crop and the planned use of growth regulators will help in achieving this objective. Growth regulators, in addition to shortening and thickening of plants, will if used at correct timings, promote root development, increase tillering and also increase grain numbers.

Excessive use of growth regulators or their use on crops under stress will cause serious crop loss.

Product	Rate/ha & Timing
Winter Wheat	
Cycocel (Chloromequat Chloride)	Single appl. - 1200 - 1400 gms at GS. 25 - 31 Split - apply 1125 gms at GS. 25 followed by 560 gms at GS. 30 - 31
Ceraide	1.2L at G.S. 13 - 31
Meteor	Single appl. 2.5L at GS 30 - 31 Split - apply 1.75L at GS 23 - 30 followed by 0.75L at 30 - 31
Moddus	0.4 L at GS 30 - 39
Spring Vars. (Autumn Sown)	
Cycocel (gms)	As per winter wheat.
Spring Wheat	
Cycocel (Chloromequat Chloride)	750 gms at GS 25 - 31
Ceraide	0.8 L at GS 13 - 31

HARVESTING & STORAGE

At harvest wheat must take priority over other grain crops. Harvest when straw is dead, golden in colour, and moistures are ideally under 23%. Delayed harvesting can result in sprouting and discolouration when weather is poor. In difficult conditions it may be necessary to harvest at moisture up to 30% to avoid losses through sprouting. Wheat with high moisture readings must be dried immediately and should not be left in trailers overnight. Drying bread making wheat demands skill and accuracy if gluten damage is to be avoided. The maximum air temperatures must not exceed 67°C at 20% moisture and 55°C at 30% moisture.
Once dried the grain must be kept cool with adequate ventilation.

Proper segregation of the grain is essential where milling and feed wheats are produced on the farm.