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RYEGRASS SEED CROPS

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Perennial ryegrass seed has been one of the most profitable large scale arable crops in the long term, where good yields have been maintained. The key factor in producing high yields of quality ryegrass seed is to take a 'specialist crop' approach. By following the principles given here, specialist growers are achieving consistent seed yields of 1500 kg ha".

ESTABLISHMENT

Site: Ryegrass seed crops can be grown successfully on most arable soils in Canterbury, with the proviso that if light soils are chosen irrigation may be required and that if heavy soils are chosen, extra care must be taken in breaking down clods prior to sowing. Medium fertility soils are generally adequate for ryegrass seed production as extra nutrients can be applied if necessary; highly fertile soils can result in excess dry matter production resulting in problems at harvest time.

Isolation: Ryegrass seed crops must be isolated from each other by 200 m if the area is less than 2 ha and 100 m if the area is larger than 2 ha. They must also be isolated by 20 m from tall fescue and 5 m from fine fescue.

Paddock history: The selected paddock must be free of goosegrass, hair grass, wild oats and yellow gromwell. This can be ensured by preceding with a rotation such as wheat, greenfeed, peas/barley and then ryegrass.

Time of sowing: Ryegrass seed crops can be sown successfully from February to early April, depending upon climatic conditions.

Seed-bed preparation: Early seedling growth can be greatly aided by thorough preparation of a fine, firm, weed-free, well-compacted seed bed.

Seed: The purity and germination certificate of seed should be examined before purchased to ensure that (a) weed free seed is being bought and (b) seed vigour (indicated by the interim germination) is adequate. Seed with the lowest contamination and highest germination should be chosen.

Sowing rate and depth: Ryegrass is generally sown at 10-12 kg ha" (though some specialist growers are still using higher rates of 20 kg ha-') in 1.5 cm rows with a conventional drill followed by a light set of harrows.

Research has indicated that ryegrass seed crops sown at 5, 10, 15 and 20 kg ha^{-1} produce the same seed yield; below 5 and above 20 kg ha" there is some

reduction in seed yield. *At very low sowing rates (less than 5 kg ha^{-1}) there may be intra-plant competition between tillers resulting in poor seed head production and low seed yield. At high sowing rates (greater than 20 kg ha^{-1}) inter-plant competition is high resulting in poor tiller and seed head production.

Growers tend to sow at 12-15 kg ha^{-1}, probably because this is what they feel comfortable with. At low seeding rates insecticide and fungicide seed, treatments may be necessary in order to improve the chances of seedling survival, and weed control is critical. Thus the increased costs associated with low seeding rates may be grater than the value of the seed. On the other hand, when seed is limited and a rapid increase is required it should be remembered that halving the seeding rate means that twice the area can be sown.

Sowing depth is 10-20 mm. Companion crops are not recommended for ryegrass seed production.

Fertiliser: Opinions differ as to whether fertiliser application at sowing is necessary or not. Although no response to fertiliser at sowing has been recorded in the following seed yield, most farmers do apply some fertiliser. This ensures that the crop is well established prior to winter and is not nutrient deficient during the late autumn/winter period when it may be required for grazing purposes.

Part of the answer. to the dilemma lies in the initial relationship between sowing rate and tiller size. As sowing rate is decreased, with the result that seedling numbers are decreased, the amount of N available per seedling is increased, i.e., the pool of available nitrogen in the pool is divided between fewer plants. Thus part of the answer to the question of how to achieve vigorous seedling growth is to decrease the seedling population. If the pool of residual soil nitrogen is low, or if sowing is late (leaving little time for development before winter),. the addition of nitrogen is likely -to help seedling development. Thus there is a balance between soil nitrogen, sowing rate and sowing date.

Research has indicated that autumn fertiliser (nitrogen and phosphate) results in increased dry matter. This is due almost entirely to an expansion in the leaf blade and has been associated with relatively small growing points; plants without fertiliser have smaller leaves and larger apices. For seed production larger apices are likely to be an advantage, but if winter feed is required autumn nitrogen is of benefit.

Ryegrass has a very great capacity to 'compensate in terms of its yield components. One of the reasons for advocating early 'sowing is that the best seed yield comes from autumn' tillers as they have time' to develop 'more florets per spikelet and more' spikelets per head than. do spring tillers. -However, the grower can compensate by boosting the-numbers of spring tillers with judicious application' of nitrogen. More tillers with fewer seeds can result in the same seed yield as-fewer tillers with more seeds.

Fertilisers in common use include DAR, superphosphate, cropmaster 20, urea and ammonium sulphate. The type and rate of fertiliser depends upon soil tests and climatic conditions. Rates of 200 kg ha^{-1} cropmaster 20 or 40-80 kg ha^{-1} urea are not uncommon. Sulphate of ammonia (185 kg ha^{-1}) can be used in late autumn in areas where sulphur is deficient and winter grazing is required . Zinc sulphate is used where zinc deficiencies are possible (e.g., Lyndhurst silt loam). Lime may also be used when pHs are low (i.e., less than 5.7).

Insecticide: Dasanit 5G at 11 kg ha^{-1} sown with the seed is effective against grass grub, black beetle larvae and argentine stem weevil.

FIRST YEAR MANAGEMENT

Rolling: Heavy rolling as soon as the crop is well-established,promotes tillering, buries rocks, levels the soil and squashes grass grubs. A second rolling after the last grazing (before closing) can also be beneficial..

Weed control: Autumn weed control can be effected by grazing or use of sprays. In spring the crop may have to be sprayed depending upon autumn treatment and paddock history. Although there are very few herbicides registered for use in ryegrass seed crops, a certain amount of success has been achieved using those registered for cereals, e.g., Axall. It is a broad spectrum herbicide which, at 3 litres ha-', is effective against many weeds, (up to the 8-leaf stage) found in ryegrass seed crops.

Fertiliser: Urea is generally applied in late winter (early August) and spring (mid-September) at spikelet initiation (when a bump in the tiller can first be felt). Forty to 60 units of N at each application are recommended, the higher amounts being used on less fertile soils which are likely to have lower reserves of soil nitrogen.

GRAZING MANAGEMENT

The crop should be managed for seed production not feed production if high seed yields are envisaged. The grazing/fertiliser regime should aim to produce a maximum number of strong autumn/winter tillers as these are the most productive in terms of seed yield. Grazing in early winter can be used to remove growth and allow light into the base of the plant (hence promoting tillering). Subsequent grazing should be light. Under experimental conditions highest seed yields have been obtained from lax (one grazing to 4 'cm in late August) and ungrazed crops. However, bulk at harvest can cause management problems leading to seed loss. Thus for large-scale production, winter grazing to a height of 4 cm is recommended.

Closing: Crops should be closed before the initiation of reproductive growth in early September. This prevents damage to, or removal of, the reproductive heads.

Growth regulators: Large losses in potential yield of ryegrass seed crops occur if the crop is subject to heavy lodging, particularly before flowering. In England, where high rates of nitrogen result in heavy lodging of crops, growth regulators such as Cycocel and PP333 have been used to increase seed yield. In New Zealand, where lodging is not generally a problem, particularly before flowering, the use of Cycocel (4 litres ha^{-1} at closing)-in ryegrass seed crops has not been shown to reduce straw length or lodging, but has resulted in consistent yield increases. Many farmers actually consider that the crop should lodge before harvest as a protective measure against heavy rain or high winds which might result il seed shedding.

The use of growth regulators on grasses has given extremely variable results in terms of seed yield. One of the biggest reasons for the variation is differences in environment; most of the basic research on growth regulators was done in the United Kingdom or the North Island of New Zealand where conditions are very different from Canterbury. The second major reason for variation lies in timing. Timing of application of regulators is critical, much more so than it is for nitrogen. Experience suggests that the earlier a growth regulator is applied the better; spikelet initiation or slightly earlier appears to be optimum (around mid-August for ryegrass).

Various responses to growth regulators have been noted. PP333 has reduced the height of the crop in the early stages but by the time flowering occurred there was no difference between PP333, cycocel and control. All treatments lodged equally but at harvest the growth regulator treatments appeared to have a 20% higher seed yield than the control. The increase appeared to be due to a decrease in both seed abortion and dressing loss. Furthermore, the use of cycocel appears to result in increased tiller survival and leaf tissue stays greener longer. It is possible that cycocel has a fungicidal effect, but this has yet to be investigated.

In other research, Cycocel applied no later than the appearance of the second node has resulted in a seed yield increase due to extra heads. This may be a result of the chemical removing apical dominance and hence allowing extra tillers to develop which produce extra heads. Unlike treatment with PP333, the use of cycocel did not decrease straw length or lodging.

When contemplating the use of growth regulators it must be remembered that they are not registered for use on grass seed crops in New Zealand.* Furthermore, they have a residual effect in the soil for several years. In crop rotations involving legumes and/or potatoes affects have been noticed three years after the initial application.

Fungicides: Crown rust, stem rust and net blotch result in decreased seed yields if not treated.. Tilt can be used with good effect (a) at the full rate sprayed once between ear-emergence and anthesis (b) at reduced rates sprayed at both ear-

emergence and early anthesis. Treated crops retain green leaf for about one week longer than untreated crops.

Irrigation: Moisture stress will affect seed set and seed fill adversely. Irrigation should be used when necessary to avoid moisture stress.

*Cycocel is now registered for use on grass seed crops in New Zealand.

HARVESTING

Time of harvest: Ryegrass seed crops are cut when seed moisture is 42-45%. Smaller paddocks should be cut at 42%; larger paddocks should be cut at higher moistures as seed moisture will decrease during the cutting process. The aim is to finish cutting before seed is below 40% as seed loss due to shedding will occur. The crop will be ready 21-28 days after flowering (which generally occurs at the beginning of December).

Method of harvesting: Sickle-bar mowers are considered to be the best method of cutting ryegrass because seed loss is low and the windrow formed dries quickly, is resistant to wind damage and is easy to pick up. Once the crop is cut it is at risk from the environment, therefore it should be picked up as soon as possible. If drying facilities are available the crop can be headed at 20% seed moisture and then dried to a safe storage level of 12%. Otherwise the crop must be dried in the field to this level.

It should be remembered that bulk seed may be at a very high temperature (due to solar radiation) when harvested, and temperatures may continue to rise when stored. Seed should be cooled (e.g., in drying silos or on drying floors) as soon as possible - over-heated seed loses viability rapidly. Seed is safe when it is cool and 12% moisture.'

Seed cleaning: Seed cleaning can be one of the major costs in producing ryegrass seed. and so should be minimised by good weed control in the field and good harvesting technique.

The first stage of seed cleaning occurs in the header. If the crop is in prime condition for harvesting the drum speed can be slow and the concave open. This allows minimum threshing, which means that awned weed seeds will not be damaged and can be removed readily at a later stage. The air blast should be sufficient **to** remove light seed and straw; the sample produced should then have a dressing loss of less than 20%.

POST-HARVEST MANAGEMENT

The ryegrass straw should be baled or forage-harvested as soon as possible, and the post-harvest residue grazed hard or burnt to remove new seedlings. In

general ryegrass seed crops are not taken for a- second or subsequent year, even though they can be certified for four years, because second year crop yields are considerably lower., Furthermore, the crop is more susceptible to moisture stress and nitrogen deficiency. Thus inputs are high and returns low. Most specialist growers believe that it is more lucrative to grow first year crops for seed and graze second year crops, after overdrilling with white clover, than to try and manage ryegrass seed crops for a second year.

ENDOPHYTE

Seed production is concerned with endophyte mostly during storage. There are, however, a couple of points worth considering. Firstly, *one* or two applications a season of fungicide to control rust do not appear to have any affect upon endophyte level. Secondly, applications of 100 units of nitrogen at spikelet initiation reduce the amount of endophyte infected tissue in seeds (without affecting the percentage of seeds which had endophyte) by 20%. This lower percentage results in seedlings and plants with lower levels of endophyte.

An endophyte test is available at the Ministry of Agriculture and Fisheries' Seed Testing Station and at various private laboratories for any farmer willing to pay for it. At the moment the test is optional.

At present all Basic Seed lines are tested and the highest endophyte lines are used for commercial seed production. However, it should be remembered that not all areas in New Zealand actually require high-endophyte ryegrass for persistence. In areas like Southland where stem weevil is not a problem, the difficulties with stock management and ill-thrift on high-endophyte grasses are entirely unnecessary. The industry must become more aware of the advantages and disadvantages of endophyte and produce a variety of seed to meet a variety of requirements.

BLIND SEED

Blind seed disease was a national disaster in terms of ryegrass seed quality only 25 years ago, however the incidence of blind seed in ryegrass has decreased markedly over the past 20 years.* The major reason for this decrease is thought to be the increasing use of nitrogenous fertilisers. Research has shown an inverse correlation between the two, i.e. incidence of blind seed disease decreases as nitrogen application increases.

It is no longer of national importance, but can be of importance to individuals in some seasons. Spores of the disease are widespread within New Zealand; probably every fence-line and roadside verge has the fruiting bodies of the fungus. This means that it can blow into a field from outside sources, just as head smut can blow in and infect prairie grass seed crops. Thus in some areas and in some years when climatic conditions during flowering favour the development of the disease (the pathogen requires moist, humid conditions), it can be a problem. A second year crop is more at risk from the disease than a first year crop because spores from

the first year can overwinter in the soil and cause increased infection in the second year. Fungicide control is not considered to be-economic because of the likelihood of contamination from outside sources.