CLEANER SEED BY MACHINE DRESSING

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Summary

Seeds, as they arrive at a seed-cleaning plant, are never pure. They have to be processed so that pure live crop seed can be obtained for reseeded the land. This culling of impurities can be achieved by mechanical devices which remove unwanted seeds from crop seeds by the physical differences within the mixture of seeds. The aim of seed cleaning is to remove the impurities with the smallest possible loss of the good crop seed. Seed-cleaning machines have the ability to remove these impurities but only when these machines are used by knowledgeable and skilled operators. It is well recognized that the operation of seed cleaning is 10% machine and 90% operator's "know-how".

SEED CLEANING MACHINES

To HANDLE weed seed extraction from crop seed, cleaning machines use three basic principles:

- (1) Cylinders — removal by difference in length.
- (2) Screens — removal by difference in diameter and thickness.
- (3) Aspiration — removal by difference in weight.

Serious problems occur when weed seeds and crop seeds are equal in size — that is, equal in diameter and thickness, equal in length, and equal in weight.

Cylinders perform separations on a difference in seed length. The length separator is a rotating cylinder with an adjustable trough. The inside surface (of the cylinder) has small, closely-spaced holes drilled into it. When seed is fed into the end of the cylinder, short seeds are lifted by the combined effect of sitting in the holes and the rotating motion. As the cylinder rotates, the seeds in the holes fall out into the trough; these are then conveyed and discharged. Any seed or trash too long to fit into the holes travels along the cylinder and falls out of openings near the end of the cylinder. Cylinders are available with holes of different sizes but all holes in each cylinder are the same size.

Screens are available in various materials, sizes and shape of opening. These screens are capable of accurate sizing for thickness and diameter. Brushes travelling continuously back and forth under the screen stop screens from clogging on many machines. The speed with which the screens are shaken in the machine has a definite effect on results; therefore modern machines are built with a variable-speed attachment to allow variation in the speed of the shake.

Aspirators are usually fans drawing air through the seed flow and this action removes dust, trash and empty glumes.

Attached to major seed-cleaning plants which use the three principles above are other special machines for the particular extraction of difficult-to-remove weed seeds and other crop seed. These are:

- (1) Specific gravity tables.
- (2) Velvet roller mills or dossers.
- (3) Electronic colour sorters.
- (4) Magnetic separators.

Specific Gravity Tables are widely used for small seeds dressing and can accomplish separations to a very fine degree in the hands of a good operator. These machines are used where only a very small weight difference is apparent and can remove heavier and lighter seeds and impurities at the same time over the table. Ryegrass species (*Lolium* species) can be removed from cocksfoot (*Dactylis glomerata*) on a specific gravity table. The ryegrass seed, being heavier, travels along the backing edge of the gravity table. Cocksfoot seed can be removed from ryegrass because it is lighter.

Velvet Roller Mills or Dossers: These machines are for the extraction of rough-skinned weed seeds from smooth-skinned crop seed. They will also remove a seed with sharp edges, such as dock (*Rumex* spp.), or sheep's sorrel (*Rumex* spp.) from white clover.

Electronic Colour Sorters: These machines separate only on colour and are used more for the removal of stained, damaged or off-type peas from pea seed. When these machines are developed to handle small seeds, a major break-through will be achieved.

Efficient as seed-cleaning machines are, they are not perfect. Almost all lines of seed contain weed seeds which resemble the crop seed closely in shape, length and weight. These troublesome weed species still often defy the machine and the brains of the operator, and remain in small quantities in machine-dressed lines.

Today most agricultural seeds are purchased and sold on a maximum of 0.5% weed seed content with a tendency for the trade to ask for lines with weed content as low as 0.1%.

Problems are often created by poor harvesting methods — many weeds are easily damaged in heading. If weeds such as bromus mollis (*Bromus mollis*) and vulpia hairgrass (*Vulpia* spp.), which are common in ryegrass and cocksfoot crops, are threshed hard, the awns or tails are broken off, which means that those weeds are then the same length as ryegrass and have to be removed on screens, with a resultant loss of good crop seed. Lines of ryegrass seed containing bromus mollis seed damaged severely during harvesting are often impossible to clean to a desired test. It is not uncommon to find these lines finishing up with anywhere from a trace to 3% of bromus mollis remaining in the line. This, of course, reduces the value of this seed to the farmer. Droughts similar to which Canterbury is prone tend to open up pastures, thereby allowing greater contamination of weed species.

Sheep's sorrel (*Rumex acetosella*) and dock are very common weed seeds in lines of white clover (*Trifolium repens*) and are often damaged in harvesting. Sheep's sorrel seed, if threshed lightly, has a very rough coat and generally is not too difficult to remove from white clover seed. When sheep's sorrel is threshed hard, the outer rough seed coat is removed, leaving the seed with a shiny brown seed coat. It is also smaller

because of the loss of the outer coat and is then most difficult to remove. To add to the problem, England, who is a big buyer of white clover seed, requires white clover seed to be free of *Rumex* spp. in the working sample. A large percentage of lines of machine-dressed white clover contain a small amount of sheep's sorrel.

The following tables give the most common impurities in various crop seeds:

Weed seeds and impurities easy to remove from ryegrasses:

- barley grass (*Hordeum murinum*)
- canary grass (*Phalaris minor*)
- broadleaf dock (*Rumex obtusifolius*)
- curled dock (*Rumex crispus*)
- fathen (*Chenopodium album*)
- haresfoot trefoil (*Trifolium arvense*)
- clustered clover (*Trifolium glomeratum*)
- sheep's sorrel (*Rumex acetosella*)
- suckling clover (*Trifolium dubium*)
- white clover (*Trifolium repens*)
- red clover (*Trifolium pratense*)
- Yorkshire fog (*Holcus lanatus*)
- catchfly (*Silene gallica*)
- vetches (*Vicia* spp.)
- poa annua (*Poa annua*)

Weed seeds which are difficult to remove from ryegrasses:

- bromus mollis (*Bromus mollis*)
- cocksfoot (*Dactylis glomerata*)
- crested dogstail (*Cynosurus cristatus*)
- ryegrass off-types (*Lolium* spp.)
- striated clovers (*Trifolium striatum*)
- sweet vernal (*Anthoxanthum odoratum*)
- field madder (*Sherardia arvenses*)
- Californian thistle (*Cirsium arvense*)
- nodding thistle (*Carduus nutans*)
- winged thistle (*Carduus tenuiflorus*)
- vulpia hairgrass (*Vulpia* spp.)
- plantains (*Plantago* spp.)
- hedge mustard (*Sisymbrium officinale*)
- wild oats (*Avena fatua*)
- wild turnip (*Brassica campestris*)
- ergot (*Claviceps sclerotia*)

Weed seeds easy to remove from white clover:

- barley grass
- storksbill (*Erodium* spp.)
- catchfly
- chickweed (*Stellaria media*)
- mouse-eared chickweed (*Cerastium glomeratum*)
- red clover (*Trifolium pratense*)
- broadleaf dock
- curled dock
- ryegrasses
- vulpia hairgrass
- bromus mollis

Weed seeds difficult to remove from white clover:

alsike (*Trifolium hybridum*)
clustered clover
plantains
sheep's sorrel
spurrey (*Spergula arvensis*)
striated clover
suckling clover
sweet vernal
Yorkshire fog
fathen
field madder
wild turnip
trigonel (*Trifolium ornithopodioides*)
earth particles
nassella tussock (*Nassella trichotoma*)
timothy (*Phleum pratense*)
self heal (*Prunella vulgaris*)

Weed seeds easy to remove from cocksfoot:

barren brome (*Bromus sterilis*)
cornbind (*Polygonum convolvulus*)
broadleaf dock
curled dock
plantains
hedge mustard
vetches
barley grass

Weed seeds difficult to remove from cocksfoot:

field madder
crested dogtail
sweet vernal
Californian thistle
winged thistle
nodding thistle
ryegrasses
bromus mollis
vulpia hairgrass
Yorkshire fog
storksbill

Weed seed easy to remove from lucerne:

barley grass
fathen

Weed seeds difficult to remove from lucerne:

- curled dock
- broadleaf dock
- spotted bur medick (*Medicago arabica*)
- bur medick (*Medicago polymorpha*)
- striated clover
- mallow (*Malva parviflora*)
- red clover
- plantain
- willow weed (*Polygonum persicaria*)
- wire weed (*Polygonum aviculare*)

Weed seeds easy to remove from timothy:

- bromus mollis
- canary grass
- ryegrasses
- Californian thistle
- nodding thistle
- vulpia hairgrass

Weed seeds difficult to remove from timothy:

- crested dogstail
- curled dock
- broadleaf dock
- field madder
- plantains
- suckling clover
- sweet vernal
- white clover
- Yorkshire fog

Weed seeds easy to remove from red clover:

- barley grass
- bromus mollis
- vulpia hairgrass
- fathen
- Yorkshire fog
- sheep's sorrel

Weed seeds difficult to remove from red clover:

- curled dock
- broadleaf dock
- plantain
- striated clover
- willow weed
- Californian thistle
- nodding thistle
- Scotch thistle
- winged thistle
- wire weed
- field madder
- mallow

PLANT DESIGN

Many factors must be considered in designing a modern seed-cleaning plant. Cleaning the seed should be accomplished without damage to the crop seed which could affect its germination. A minimum of plant is essential for economy and it must be easy to clean the plant when changing varieties. It should also be of continuous flow design from beginning to end, but flexible enough to by-pass any unit. The volume of seed to be processed, the kinds of contaminating seed crop and weed seeds must be considered to arrive at the best possible design. There is no all-purpose complete machine capable of removing all weed seeds and trash from different kinds of seed. It is important that each unit of a seed-cleaning machine be installed in its correct sequence. When a seed line arrives at the hopper of the cleaning machine, a sample of the line must be analysed to determine the use of correct screens, correct setting of cylinders, as well as the need for special machines. Time spent at this point is usually well spent and will decrease the amount of redressing or recleaning to arrive at good marketable condition. The seed-cleaning machine is the last step in the quality control of future pastures and crops. Too much well-grown New Zealand seed has been and still is inefficiently handled, more through poor cleaning plant design and ignorance than anything else.

CONCLUSION

Skilful seed cleaning should always back up the wonderful efforts of our plant breeders. At times these efforts have been nullified by good seed still containing weed seeds that should have disappeared down into an offal bag. Those in the industry urgently need to improve its standards and education for the benefit of all.

Broadly summing up, a greater co-ordination between skilled header operators and skilled seed-cleaning plant operators is very much overdue and necessary. It is a simple procedure of greater education of the two because both are vital to the success of good clean seed production. As in all things, anyone can do a worse job with less effort in an attempt to do it cheaper, whereas this industry deserves and requires the best from beginning to end.