# NATIONAL AGRICULTURAL CONFERENCE

# BURNING BAN — THE FINAL STRAW ?

Abstracts.

## WEDNESDAY 28th NOVEMBER 1990

Jointly organised by:
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BURNING BAN – THE FINAL STRAW
CONFERENCE WEDNESDAY 28 NOVEMBER 1990

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# FARMERS' FEARS

## TOXINS AND STRAW RESIDUES

DR R D PREW + BACON ETC

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# TOXINS AND STRAW RESIDUES

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Straw residues have the potential when incorporated to cause problems in the following ways:

(1) Mechanical interference
(2) Straw decay and toxin production
(3) Source of carry over of diseases
(4) Habitat and food source for pests
(5) Nitrogen availability
(6) Carrier for weed seeds

This paper will consider the first three topics mainly in relation to continuous cereal sequences. Other speakers will deal with aspects of the last three topics.

Mechanical Interference

Mechanical interference is mostly a problem in relation to drilling and can result in decreased plant establishment. Surface straw can either block the drill or it can be pushed into the drill slit and prevent good soil/seed contact. Factors that might be involved in such problems are the amount of straw, the chop length, degree of incorporation and drill type.

Trials at Rothamsted have shown that provided the other factors are of an acceptable standard up to four times the normal amount of straw (ie approx 20 t per ha) can be successfully incorporated either by tines or plough. For the farmer this means that the requirement for uniformity and accuracy of spread is not critical.

Chop length initially caused much concern but results show that although chopping is essential for non-inversion systems and very desirable for inversion ones, the length of chop achieved on well set combine-mounted or trailed choppers is quite adequate.

The degree of incorporation particularly in shallow non-inversion systems is the most important of these factors but with the right choice of drill, large amounts of surface trash can be drilled through without problem.

The choice of drill is partly dependent on the ability to penetrate or push aside trash but mainly on the closeness of row and degree of stagger between rows of coulters. There can also be a problem of getting sufficient consolidation following drilling in light textured soils with a shallow incorporation system. The straw/soil mix forms a soft "mattress" and even when rolled will not consolidate.

Straw Decay and Toxin Production

Straw decay occurs when the soil microbial population uses straw as a source of carbon and energy. Straw consists mainly of cellulose (40%) hemicellulose (35%) and lignin (15%). Initial decay is very fast but then slows down because the lignin, which is very slow to decay, protects a proportion of the cellulose and hemicellulose. The rate of decay increases with increasing temperature and moisture and adequate oxygen; although if moisture is excessive the system becomes anaerobic with little decay. In the early stages of decay there is a high demand for oxygen and temporary anaerobic conditions can occur. These may result in the accumulation of organic acids known to affect germination and seedling growth. Fortunately this rarely seems to be a cause of major problems in the field unless the seed is sown into a compressed surface mat of straw.

There have been some deleterious effects on early growth resulting in crops that were smaller and yellower; by April their dry weight was occasionally halved. However, compensatory growth has always occurred and yields have not been significantly affected. These effects were most likely associated with transient nitrogen deficiency but the possibility that a toxin was involved can not be ruled out. Such effects have usually occurred with shallow incorporation systems in particular in the presence of a thick chaff layer.

The rate of decay does not appear to be affected significantly by soil type, species of cereal or chop length. In nearly all circumstances the rate of decay is such that by the end of the first twelve months the straw is more than 60% decayed and after twenty four months what remains are fragments that form part of the soil organic matter. Under these conditions there is no long term accumulation of straw and thus there seems to be no requirement for the addition of chemical or microbial accelerators.

Carry-over of Disease

Effects of straw residues on disease incidence may occur either by changing the distribution and survival of inoculum or by altering the infection conditions. It was expected that the diseases most likely to be increased were the foliar, trash-borne diseases and in the absence of fungicides septoria, rhychosporium and net blotch have all been somewhat greater in the presence of surface straw. However, with the use of standard fungicide applications all are adequately controlled and no increases are found in the presence of surface straw residues.

Eyespot which survives on the stubble was also expected to increase with surface straw; but experiments have shown that there is a tendency for it to be decreased compared with burning, possibly because of competition from faster growing saprophytic fungi that readily colonise straw on or near the soil surface. Fusarium infections on the stem base have been more prevalent with shallow incorporation but the lesions have mostly been slight and would not be expected to cause yield loss. However the yield loss relationship of this disease is not clearly defined and more work is needed to clarify the problem.

Cephalosporium leaf strip has, on one experiment, been greatly increased by direct drilling or shallow cultivation in the presence of straw; but on other sites it has not proved to be a problem.

Take-all has been little affected by the presence of straw, although failure to adequately consolidate the seedbed or temporary nitrogen shortage will favour take-all and could sometimes be brought about by straw incorporation. Take-all has developed faster in a sequence of cereal crops sown after shallow cultivation than after ploughing. However as is common with take-all, later in the sequence this effect is reversed as the shallow cultivation sequence moves more quickly into take-all decline.

Finally Barley Yellow Dwarf Virus (BYDV) has been found by colleagues at Long Ashton to be affected by cultivation method and straw presence. On a site with high infection pressure, systems with the least soil disturbance have had least BYDV and this effect has been more marked in the presence of straw. The explanation seems to be related to increased population of aphid predators.

Conclusions

The paper has concentrated on the effects of straw residues in sequences of winter sown cereals and has shown that in such sequences there are no insuperable agronomic problems related to mechanical feasibility of incorporation, straw decay or disease carry over. In sequences other than winter sown cereals, the mechanical and straw decay effects will still occur but they may be modified, particularly by the time interval involved. In general spring sown crops are likely to be less affected because the extra time allows the straw to be ploughed down in virtually all soils and also for considerable decomposition to have taken place prior to sowing. In contrast, following cereals with autumn sown oilseed rape seems to cause more problems, the seeds of rape appear more sensitive to unfavourable seedbed conditions and the time interval especially following wheat is very short. At present ploughing is the best method of incorporating straw before sowing oilseed rape but obviously on many of the heavy soils it is not possible to get a sufficiently fine seedbed following ploughing. In these soils it is not yet possible to recommend a system that is consistently satisfactory in all seasons.