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Glasshouse Trials 1970

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Two glasshouse trials were carried out:-

- (1) Effect of Placement of Urea and Soil Moisture Level on Germination of Wheat.
- (2) Effect of Placement of Urea on Germination of Wheat, Oats, Barley, Linseed and Rape.

1. Germination of wheat was adversely affected by drilling urea in contact with the wheat seed and also by high rates broadcast. Rates used were the equivalent of 50, 100, 150, 300 and 450 lb urea/acre. Generally the effects were not as severe (at least at the lower rates) as have been observed in field trials. This may be mainly due to the greater intensity of water application in the pots compared with the field situation, even though both situations received the same total amount of rain.

The harmful effects were of three types:-

- (a) Delayed germination.
- (b) Reduction in the maximum number of plants germinating.
- (c) Death of plants already emerged.

The effect of broadcast applications was mainly on the death of emerged plants. Drilled urea had an effect at all three stages. These effects could have been due to a number of causes and all could have been operating in this case. Delayed germination could have been due to high osmotic pressure of the soil solution due to large amounts of fertiliser. The main effect would have been due to the presence of high levels of free ammonia which is formed during hydrolysis of the urea. Free ammonia is toxic to plants. A third factor could have been due to a build up in the level of nitrite nitrogen during the later stages. This nitrite nitrogen is also toxic to plants and could have been the cause of some of the later plant deaths. Nitrite nitrogen is an intermediate product of the process of nitrification from ammonium nitrogen to nitrate nitrogen.

Ammonium $\xrightarrow{\text{(nitrosomonas)}}$ nitrite $\xrightarrow{\text{(nitrobacter)}}$ nitrate

High levels of free ammonia tend to affect the nitrobacter more than nitrosomonas, so that the second part of the process is slowed down more than the first part. This results in a build up in the level of nitrite nitrogen, which is normally converted to nitrate nitrogen as quickly as it is formed.

As would be expected the harmful effects on germination were more marked as the rate of urea was increased. However, the degree of harm caused was also influenced by pre- and post seeding moisture levels. If the pots were watered to simulate rain immediately after seeding, the harmful effects of drilled urea were reduced considerably. If no rain was received after seeding the harmful effects were greater in initially moist soil than in dry soil. This latter effect is due to the fact that there is just enough moisture to start the seeds germinating and hydrolysis of urea also commences, resulting in the formation of free ammonia. However, there is not enough moisture to dissolve and remove much of this ammonia from the immediate vicinity of the germinating seeds.

Therefore the germinating seeds would be exposed to high concentrations of free ammonia.

Maximum harm to germination in the field could be expected when the crop is sown into moist soil and there is a rainless period following planting.

2. The cereals wheat, oats and barley were sown to a depth of one inch, while the linseed and rape were planted $\frac{1}{2}$ inch deep. Rates of urea were 100 and 300 lb/ac drilled or broadcast and the super rate was equivalent to 230 lb/ac.

Within the cereals, barley was relatively unaffected, as regards germination, with all treatments. Wheat and oats were adversely affected to some extent. At the higher rate the oats were affected worse than wheat.

By comparison, the linseed and rape germination was affected a great deal more than any of the cereals. Both drilled and broadcast applications of urea had drastic effects on rape and linseed. Rape was affected a little more than linseed. In addition the super drilled with the seed was almost as harmful to germination as was the urea.

The super reduced emergence of rape and linseed from 86% to 47%. Emergence of both crops was further reduced to about 14% by drilling urea at 100 lb/acre with the seed. When the rate of urea was 300 lb/acre only 4% of the plants that were capable of germinating, did so. Urea broadcast at either rate had an adverse effect on emergence of rape, whereas linseed was only affected by the high rate of urea broadcast.

The effect of super was probably more marked than in the field because it was powdered and placed in close contact with the seed.

FIG 1

WHEAT : ○—○ NIL NITROGEN , ●—● UREA 300 lb/ac DRILLED , ⊙---⊙ UREA 300 lb/ac BROADCAST
 CATS : △—△ NIL NITROGEN , ▲—▲ UREA 300 lb/ac DRILLED , ▴---▴ UREA 300 lb/ac BROADCAST
 BARLEY : □—□ NIL NITROGEN , ■—■ UREA 300 lb/ac DRILLED , ▣---▣ UREA 300 lb/ac BROADCAST

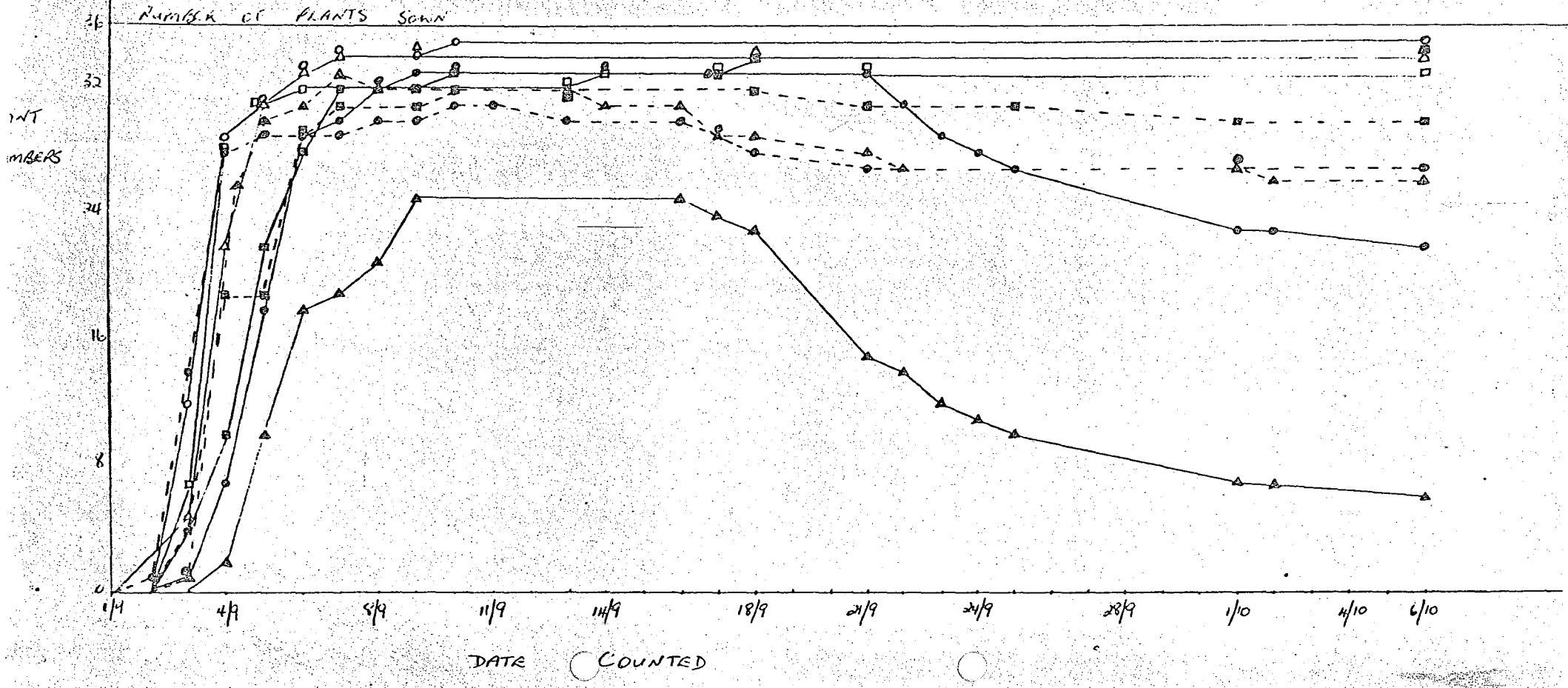


FIG 2

- LINSEED - NO FERTILISER
- LINSEED - SUPERPHOSPHATE 230lb/AC DRILLED
- x—x LINSEED - SUPERPHOSPHATE 230lb/AC + UREA 100lb/AC DRILLED
- x--x LINSEED - SUPERPHOSPHATE 230lb/AC DRILLED + UREA 100lb/AC BROADCAST
- : RAPE △—△
- : RAPE △—△
- : RAPE ■—■
- : RAPE ■—■

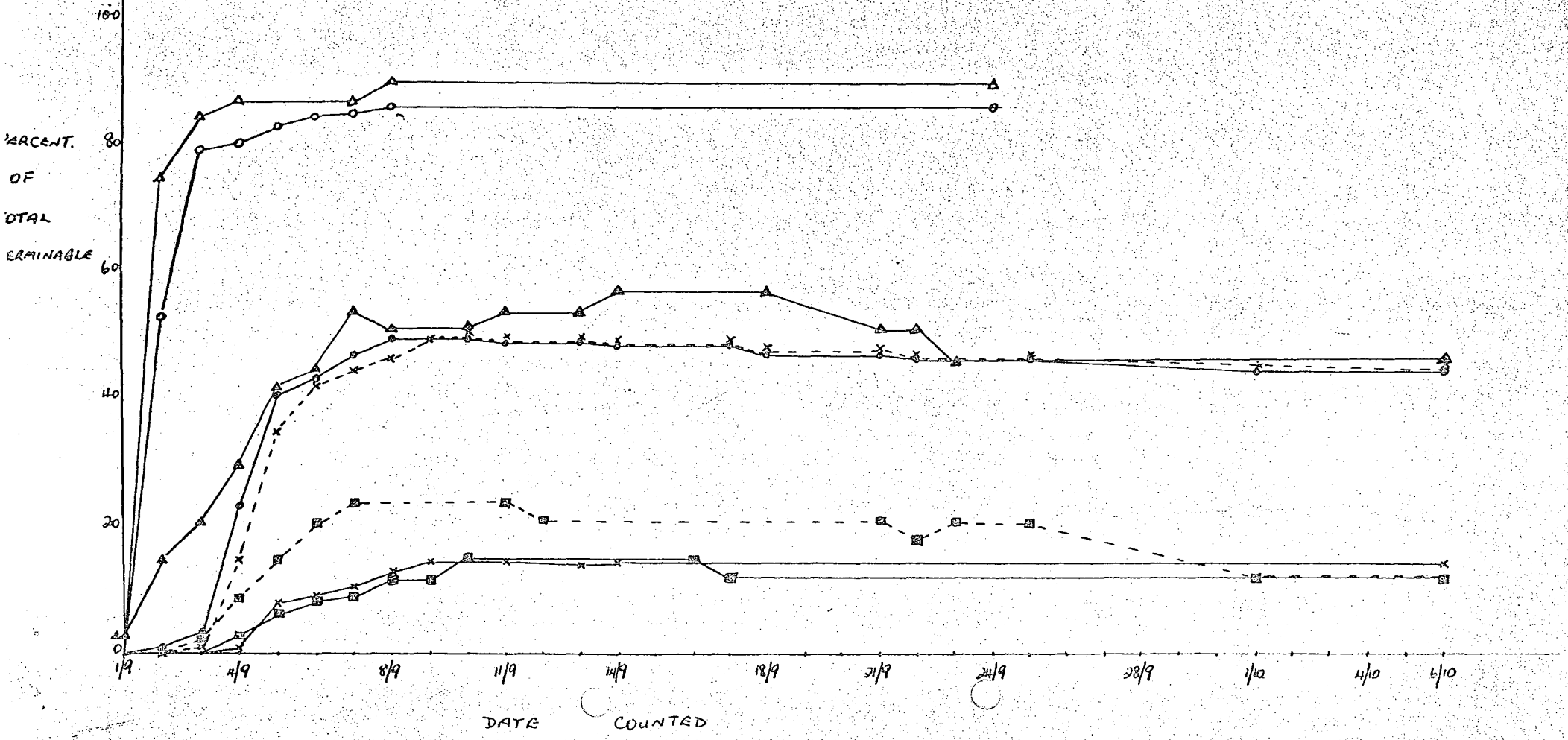
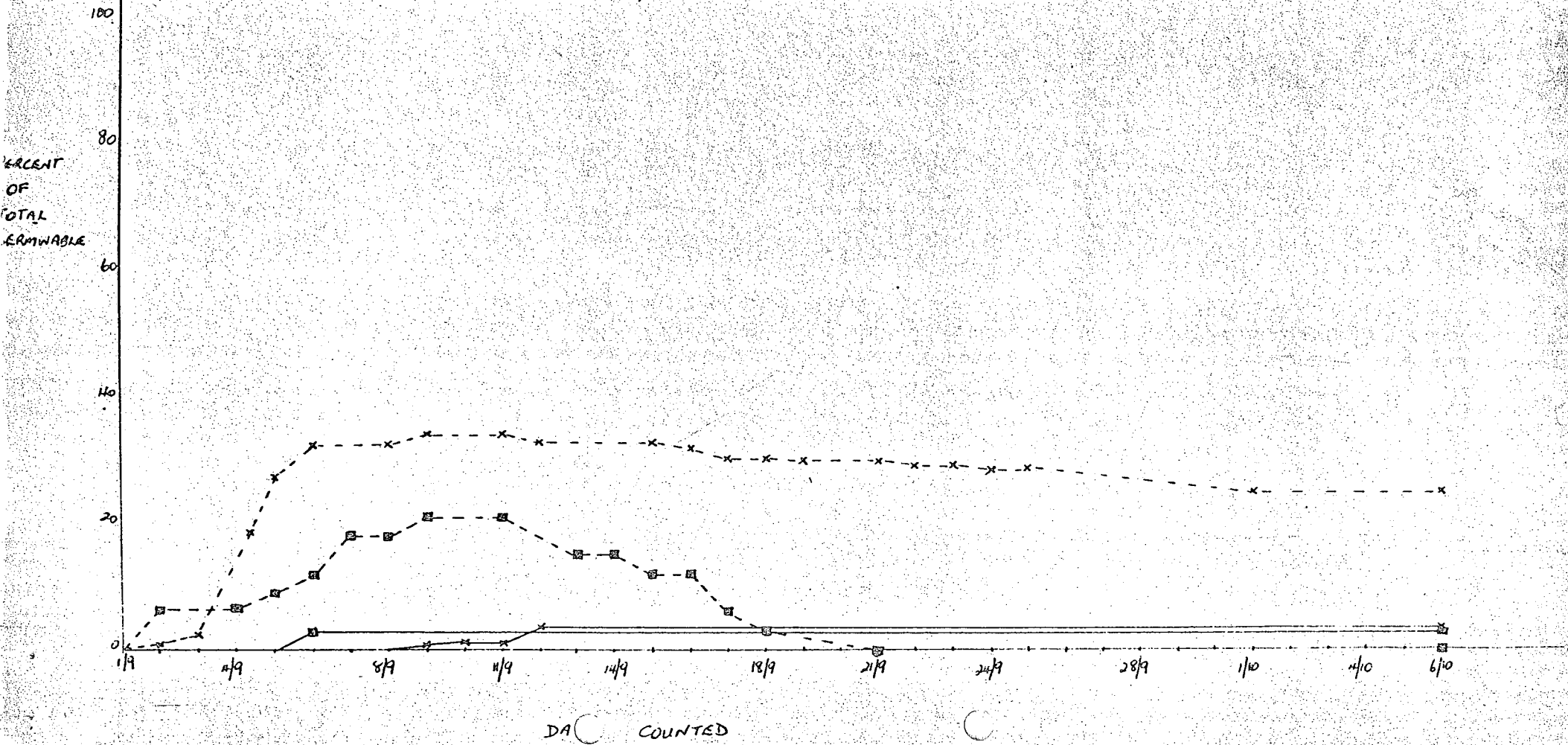


FIG 3

- x—x LINSEED - SUPERPHOSPHATE 230 lb/ac + UREA 300 lb/ac DRILLED
- x---x LINSEED - SUPERPHOSPHATE 230 lb/ac DRILLED + UREA 300 lb/ac BROADCAST
- RAPE - SUPERPHOSPHATE 230 lb/ac + UREA 300 lb/ac DRILLED
- RAPE - SUPERPHOSPHATE 230 lb/ac DRILLED + UREA 300 lb/ac BROADCAST



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