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Using Solid, Bulk Blended Mixed-Grade Fertilizers

K. L. Wells and J. D. Green

Most solid, mixed fertilizers used in Kentucky are prepared by physically mixing two or more fertilizer materials to a desired analysis. The ingredient materials most commonly used to prepare mixed fertilizers in Kentucky are diammonium phosphate, urea, ammonium nitrate, muriate of potash, and sulfate of potash. During the period January - June, 1990, these 5 materials made up 60% of the 700,000 tons of fertilizer used in Kentucky. And just three of them...urea, diammonium phosphate and muriate of potash...made up 47% of the total used during that period.

Characteristics of Solid, Bulk Blended Mixed Fertilizers

Fertilizer materials used for bulk blending are of granular shape, most having been granulated, crushed to granular size, or prilled. Since each material is from a different source, individual granules in the blend contain only one or two nutrients. For example, every granule in a 12-24-24 bulk blended fertilizer does not contain all three of the nutrients. Some granules will be composed of diammonium phosphate,

containing both N and P_2O_5 ; others will contain only N from either urea or ammonium nitrate, and others will contain only K_2O from muriate of potash. This contrasts to the dominant way in which solid, mixed-grade fertilizers were made several years ago when sources of N, P_2O_5 , or K_2O were mixed together and then granulated, each granule then containing N, P_2O_5 , and K_2O . The number of grades made then were very limited. Currently with bulk blending, tailor-made analyses can be prepared to match the requirement of any soil test requirement. This can economically be done by local fertilizer retailers from stockpiles of rarely more than six basic fertilizer products. Agronomic performance of bulk blended mixtures has proven to be equal to that of the granulated mixtures when they are uniformly applied.

Uniformity of Solid, Bulk-Blended Mixed Fertilizers

After blending components to some desired analysis, the mixture must remain well mixed if the desired nutrient application is to be uniformly spread onto fields. Much

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research has been conducted to determine the important factors involved in keeping blended materials uniformly mixed. The major factor of concern is granule size. If all components used in blending an analysis are of similar size, the components will remain well mixed. If, however, materials are used in preparing blends which are non-uniform in granule size, there is a considerable potential for the larger granules to separate from the smaller granules during mixing, hauling, and spreading, resulting in non-uniform application of nutrients.

Field Study Conducted on Effect of Mismatched Particle Size

Field studies were conducted at two sites in Kentucky to measure the effect of nutrient non-uniformity due to use of mismatched particle size of bulk blend components on corn production. Urea, diammonium phosphate, and muriate of potash were used to blend a 30-15-7.5 analysis of fertilizer. In one case (uniform), all components were exactly of the same particle size; in another case, finer sized diammonium phosphate (fine DAP) was used; and in a third case, finer sized urea (fine urea) was used. In both non-uniform sized blends, the finer sized granules used were 40% smaller than the other granules used in the blends (-9+12 mesh size vs -6+9 mesh size). Both sites were selected to be low enough in soil test P levels that there would be a likelihood of corn yield response to fertilizer P (one site tested just below the medium level and the other site tested just above the medium level). The intended rate of application at each site was 400 lbs/A of the 30-15-7.5 blend.

These blends were applied with tractor-drawn double-spinner fertilizer spreaders in 40 ft swaths. Measurement was made every 8 ft across the swath for variation in rate and

nutrient content of fertilizer applied, and corn yields. As shown in Table 1, the desired rate of application was closely approached at site 1 (101 to 108%) but not at site 2 (160 to 164%). This variation is mostly due to differences in calibration rate of the spreaders used at the two sites. Table 2 shows the variation across the 40 ft swath due to blending with mis-matched granule sizes. The variation measured did not significantly affect corn yields at either site (test average was 147 bu/A at site 1, and 121 bu/A at site 2).

Implications For Impregnation of Dry Blends with Herbicides

One method of applying some herbicides is by use of impregnation onto dry fertilizer blends. Equivalent weed control can be obtained using impregnation compared to applications by sprayers; however, good weed control is dependent on an even herbicide/fertilizer blend and uniform application to the field. Herbicides currently registered (April, 1991) by the EPA for impregnation include Bicep, Bullet, Canopy, Command, Commence, Dual, Eradicane, Extrazine II, Freedom, Lariat, Lasso, Lexone, Lorox Plus, Prowl, Salute, Sencor, Sutan+, Sutazine, Treflan, and Turbo. Detailed directions and guidance for the impregnation process can be found on the product's label.

As shown in these studies, spreading rate variations occur both across and along the spread swath. This variation can obviously alter the herbicide distribution. Reduced weed control may occur in some areas of the field due to under application; whereas, the potential for crop injury increases due to over application in other areas.

Based on the distribution of fertilizer blends used in these studies, uniformly impregnated Prowl herbicide (pendimethalin)

applied at a target rate of 1.5 lb ai/A would vary between 1.4 and 1.8 lb ai/A.

For herbicide products such as Sutan+ (a mixture of Sutan+ and atrazine) the application of both active ingredients would be inconsistent. The Sutan+ equivalent (i.e. butylate applied at 4.8 lb ai/A) would vary from 4.4 to 5.7 lb ai/A. This could result in variable control of some weedy grasses by butylate. The atrazine equivalent applied at a target rate of 1.2 lb ai/A would also differ across the field. A double application at half-rate is generally suggested to help reduce the variability that can result from blending and application of herbicides impregnated on dry fertilizers.

Conclusions

The variation in rate of nutrient application created by mis-matching granule size of bulk blended materials in these studies did not affect corn production. However, it should be noted that the variation created (range of 93 to 114% of that obtained from the uniform blend) was not extreme. Greater variation would be expected with larger variations in granule size. Rate of impregnated herbicides would be expected to vary according to variation of fertilizer rate across and along the spreader swath.

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Table 1. Variation in spreading rate due to spreader calibration.

Blend	Site 1		Site 2	
	lbs/A	% intended rate	lbs/A	% intended rate
Uniform	403	101	641	160
Fine DAP	430	108	642	160
Fine Urea	418	105	655	164

Table 2. Variation in fertilizer rate due to blending fertilizer materials of differing granule size.

Blend	Site 1						Site 2					
	-----ft distance across swath-----											
	0	8	16	24	32	40	0	8	16	24	32	40
	-----% of rate applied with uniform blend-----											
Fine DAP	105	102	112	105	106	110	96	102	105	109	92	96
Fine Urea	101	108	114	99	99	101	93	97	114	118	95	96

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