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Corn & Soybean News

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New Field Drying Estimator for Soybean

USDA's most recent production forecast predicted this year's soybean crop at 98.5 million bushels with progress on October 10 near that of last year and the 5-year average (~30% complete). With favorable weather predicted in the next few days across much of the state then followed by more seasonal temperatures afterwards, harvest progress will likely continue towards the 5-year average of 70% by the end of this month.

LIMITS OF FIELD DRYING: Field drying is largely dependent on relative humidity, then on temperature and the amount of wind and sunshine. Soybean seeds give up and re-absorb moisture more quickly than corn and have different equilibrium moisture properties. Whether drying in the field or in a bin, the limits of drying are dictated by the average ambient conditions, as shown in the table below.

Table 1. Equilibrium soybean moisture for a range of typical ambient conditions for October in Kentucky. Source: ASABE, 2017.

	Relative Humidity (%)						
Temp.	50	60	65	70	75	80	90
F	Equilibrium Moisture Content, %wb						
40	9.3	11.4	12.7	14.3	16.3	18.9	28.7
50	9.1	11.2	12.4	14.0	16.0	18.6	28.3
60	9.0	11.0	12.2	13.8	15.7	18.3	27.9
70	8.8	10.8	12.0	13.5	15.5	18.0	27.5
80	8.7	10.6	11.8	13.3	15.2	17.7	27.1

A new tool has been posted by Clemson University to quickly calculate the equilibrium moisture content of soybean (as well as ear corn, shelled corn, and wheat) for specific locations based on a five-day weather forecast for a given zip code. After selecting the type of grain from a drop-down list, the user chooses between three prediction equations or a composite which averages their values. Designed to help grain managers make decisions on when to harvest and/or operate drying or aeration fans, this tool was used to predict the trend in moisture changes from October 12-19 for Mayfield, Madisonville and Lexington with results shown in Figure 1. Note that a drying trend of 5 points or more is predicted for all areas, and the market moisture of 13.0% will likely be exceeded in the West and Central regions by Saturday, but will take a few more days in the Bluegrass region. Keep in mind however that most weather models predict temperatures more accurately than relative humidity or rainfall, especially scattered showers.

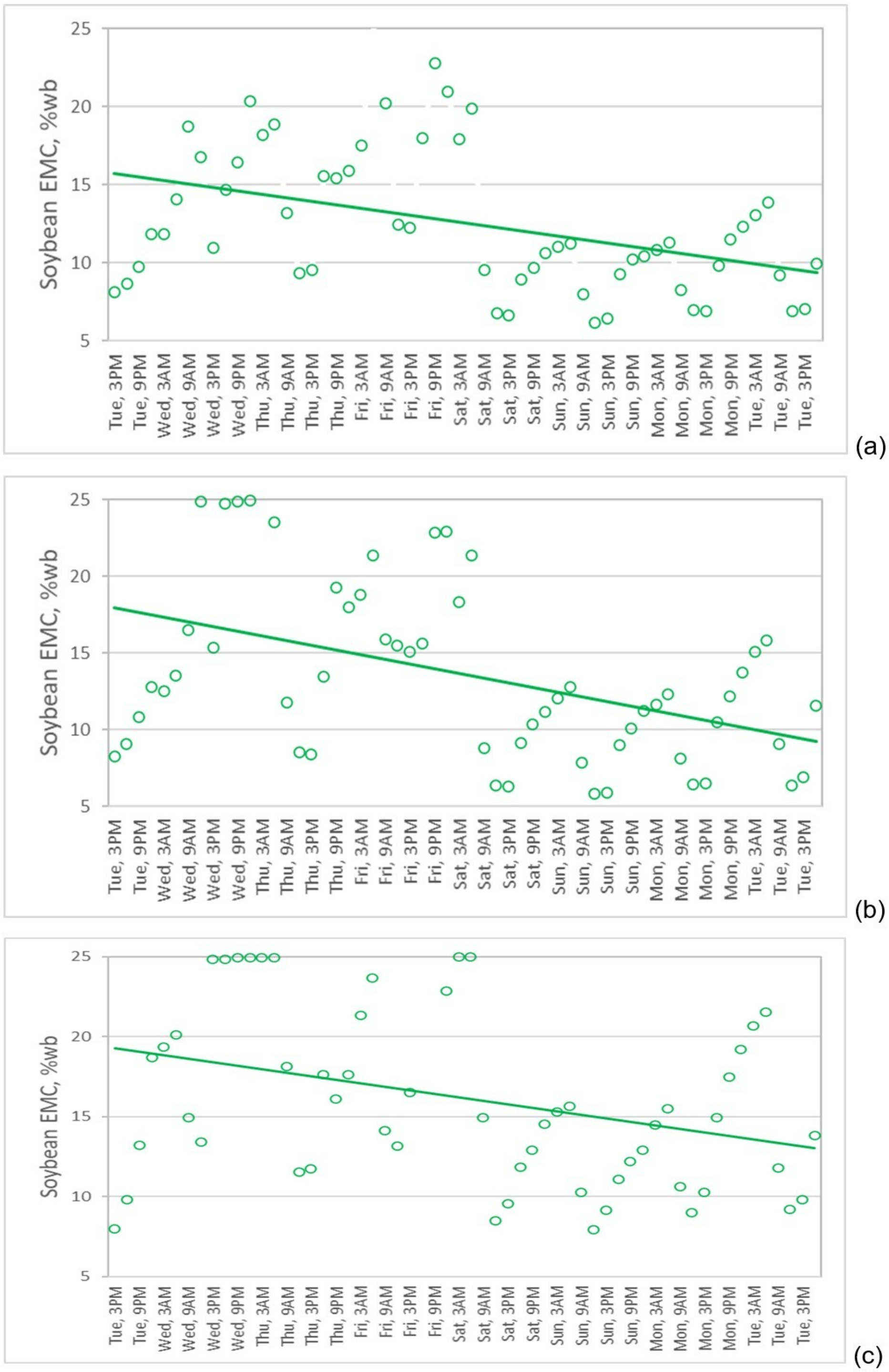

Figure 1. Predicted equilibrium soybean moisture contents at 3-hour intervals and the overall trend from Oct. 12 to 19 in Mayfield (a), Madisonville (b) and Lexington (c) based on local temperature and relative humidity levels. Source: Clemson EMC Calculator

ECONOMIC IMPLICATIONS: Net returns to the soybean enterprise for managing harvest moisture are usually higher than for other crops because of its value. At the current cash price of $12 per bushel, the value of water is about 14 cents per point of moisture. In comparison, the moisture discount at some elevators can be around 20 cents per point when delivered above 13.0%. Considering the state average predicted yield of 55 bushels per acre, soybeans delivered at 16% moisture could be discounted by 60 cents per bushel ($33 per acre), whereas loads delivered at 10% moisture would lose 42 cents ($23 per acre) due to the weight of water.

MERGING THESE POINTS: The output plot from Clemson's decision tool allows users to see if grain will gain or lose moisture or stay the same during a 5-day period. Data can easily be transferred to an Excel spreadsheet to plot a local trendline (as was done in Figure 1). Armed with that information, soybean managers in Kentucky and elsewhere can be better informed regarding profit-making decisions to control seed moisture during harvest and/or when operating fans to achieve target levels.

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Speculations on the Causes of Fall Armyworm Outbreaks in 2021 and its Management in Soybeans in Kentucky

Fall armyworms

While migrating northward from their overwintering sites in the states around the Gulf of Mexico, Mexico, and the Caribbean, female *Spodoptera frugiperda* (Lepidoptera: Noctuidae) known as fall armyworm (FAW), lay bundles of 50 to >200 eggs. Then larvae (Figure 1) emerge in synchrony and move to feast on grasses or any other host plant nearby. While they are in the first and second instars the damage is not noticeable. However, as they grow into the fourth and fifth instars (Figure 1), larger larvae (>¾ inches) become more voracious, and damage is conspicuous. The large numbers of larvae moving from the edges to the center of the field as an army of individuals give origin to its name.

Figure 1. (Left) Fall armyworm larvae emerging from egg mass and (Right) fifth instar FAW. (Photo by Raul T. Villanueva)

Causes of Outbreaks

Fall armyworm damages commonly occur in grasses and forages, and on occasions in corn. Chemical controls were conducted effectively using pyrethroid insecticides prior to 2021. However, in 2021 pyrethroids were not effective to control this pest in states of the south such as Louisiana, Mississippi, Alabama, Tennessee, Georgia, and central and northern states such as Kentucky, Ohio, Michigan, and Pennsylvania. Reasons for the poor pyrethroid efficacy can be numerous, although not yet known. Here are some possible causes for the outbreaks: development of pyrethroid resistance, new strain of FAW that might recently be moved from the Caribbean, Central or South America, and low efficacy of pyrethroids against late instars of FAW larva.

In addition, the reasons for the fails in control of the FAW population outbreaks might be to large population survival of overwintering FAW in southern regions and the continuous infestations of migrating FAW due to this survival. The temperatures in the 2020-2021 winter in the southern states may have allowed higher moth survival, and consequently high oviposition that allowed an early migration as well as higher number of individuals in these overwintering sites. These hypotheses may be tested later by researchers in different states.

Figure 2. Dead FAW larvae (>50 FAW larvae in less than 1 sq. ft. area) in an alfalfa field at the UKREC at Princeton. Photo was taken 1 day after a spray with Besiege. All alfalfa stems were completely defoliated in some areas of this field. Red circles shown "black" dead FAW larvae (Photo by Raul T. Villanueva)

Soybean Management

The 2021 FAW outbreak also resulted in injuries to many double crop soybean fields in Kentucky. This pest prefers young shoots, and some double crop soybean fields were in that stage when outbreaks occurred causing severe defoliations. Damages might have occurred in full season soybeans, but due to the abundant foliage and its resilience, damages were not notorious.

At the UKREC at Princeton there was a double-crop soybean field that began to be affected by FAW. This field was adjacent to an alfalfa field that had severe FAW damages (Figure 2). A spray was conducted with a double mode of action insecticide containing *λ-cyhalothrin + chlorantraniliprole* (Besiege®, Syngenta) at the rate of 10 fl. oz./A. Tallies of caterpillar larvae were conducted 1 and 20 days after the spray in the inner (>60 ft from edge) and border (5 ft from field edge) areas of the field in soybeans, and field in the alfalfa within the 30 ft from the edge. Tallies were conducted in 6 to 10 sites in the border or inner parts of the field with 20 net sweeps in each site. In addition, an unsprayed double crop soybean field distant approximately 0.8 miles from the alfalfa field was tallied using the procedure described above. In all fields, tallies of caterpillars included FAW, alfalfa cloverworms, velvetbean caterpillar, and soybean loopers.

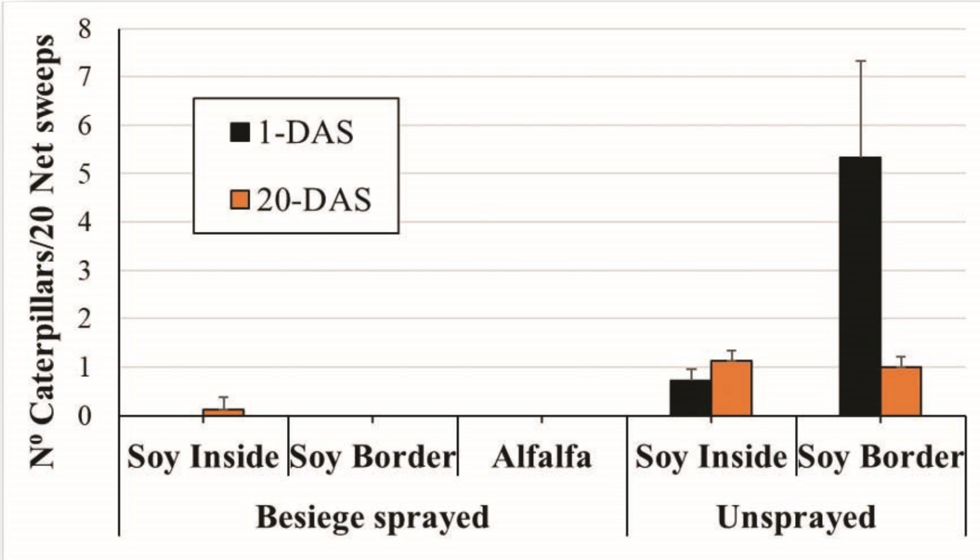

Figure 3. Mean numbers (±SEM) of caterpillars in soybean and alfalfa fields with a single spray of Besiege® (20 fl.oz./ acre); and on a distant unsprayed soybean field (0.8 miles from the alfalfa field) at 1 and 20 days after the application. Live FAW were not found on any of these dates.

In this case the dual mode of action insecticide was very effective killing different stages of the FAW larvae and controlling soybean caterpillars. Even 20 days after the application only a single velvetbean caterpillar was found in the Besiege® sprayed field, whereas no FAW was detected (Figure 3). A similar situation was observed in a commercial field in Hardin County, KY, where caterpillars were not found 4 weeks after a Besiege spray.

Besiege® and other insecticides carrying the active ingredient *chlorantraniliprole* (i.e., Prevathon®, Elevest®) were effective against FAW in 2021. Similar results are reported in studies conducted by entomologists of other states. However, these insecticides are expensive bringing about an increase of production costs that some farmers cannot afford. The cost of the product utilized in Kentucky was approximately $20 per acre while pyrethroids do not exceed $5. Currently, we cannot foresee the 2021 FAW outbreak as a single event, nor if it will repeat in 2022. Farmers and consultants need to be proactive and scout for egg masses or early instars FAW and avoid high costs insecticides. Also, it is necessary to be on the lookout for what is happening in southern states regarding FAW population dynamics.

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Improving Nutrient Use Efficiency More Important with High Fertilizer Prices

As we write this newsletter article, fall fertilizer prices continue to increase, albeit at a slower pace for most materials than earlier this fall. The latest DTN retail price survey https://www.dtnpf.com/agriculture/web/ag/crops/article/2021/10/06/fertilizer-price-gains-losing-steam has urea (46-0-0) at $620/ton, DAP (18-46-0) at $722/ton and potash (0-0-60) at $647/ton. This gives $0.675/lb N, $0.52/lb P_2O_5 (after accounting for the N value in DAP), and $0.54/lb K_2O. Compared to this time last year, urea, DAP and muriate of potash are 71, 64 and 92% higher, respectively. Other important materials used in Kentucky are also higher: ammonium polyphosphate solution (APP, 10-34-0); UAN (32-0-0); and anhydrous (82-0-0) are 40, 78 and 84% more expensive, respectively. When fertilizer prices are high, improving profitability and/or the probability of an economic response to fertilizer addition becomes more critical and more of a challenge.

The first task is to have recent soil test information for your fields. This is especially important with high fertilizer prices and is also important this year because nutrient removal in grain was also high, with the good grain yields. Soil sampling (Figure 1) provides you data that will be the basis of your field-by-field nutrient management plan. You can use soil test data to 'target' lime and fertilizer applications to fields/field areas that have more potential to give you a profitable response to those additions.

Figure 1. Taking a composite soil sample of 15 to 20 cores from each representative area/zone within a field, is the most important step in the soil testing process. The sampling depth should be 4 inches in no-till fields and deeper, to the depth of primary tillage, in tilled fields (photo courtesy Chris Teutsch). See also AGR-16, Taking Soil Test Samples (http://www2.ca.uky.edu/agcomm/pubs/agr/agr16/agr16.pdf)

The first soil test result to check is the field's soil pH and lime requirement (if any). The 'fixation' that lowers plant availability of nutrients like P is itself often reduced by maintaining soil pH between 6 and 7 (Figure 2). Acid soils inhibit N fixation and growth of soybean. Agricultural lime is widely available in Kentucky, ag lime price changes have not been notable, so liming those fields with acid soils is a priority. Because of its high price, pelletized lime is not recommended for row crop fields.

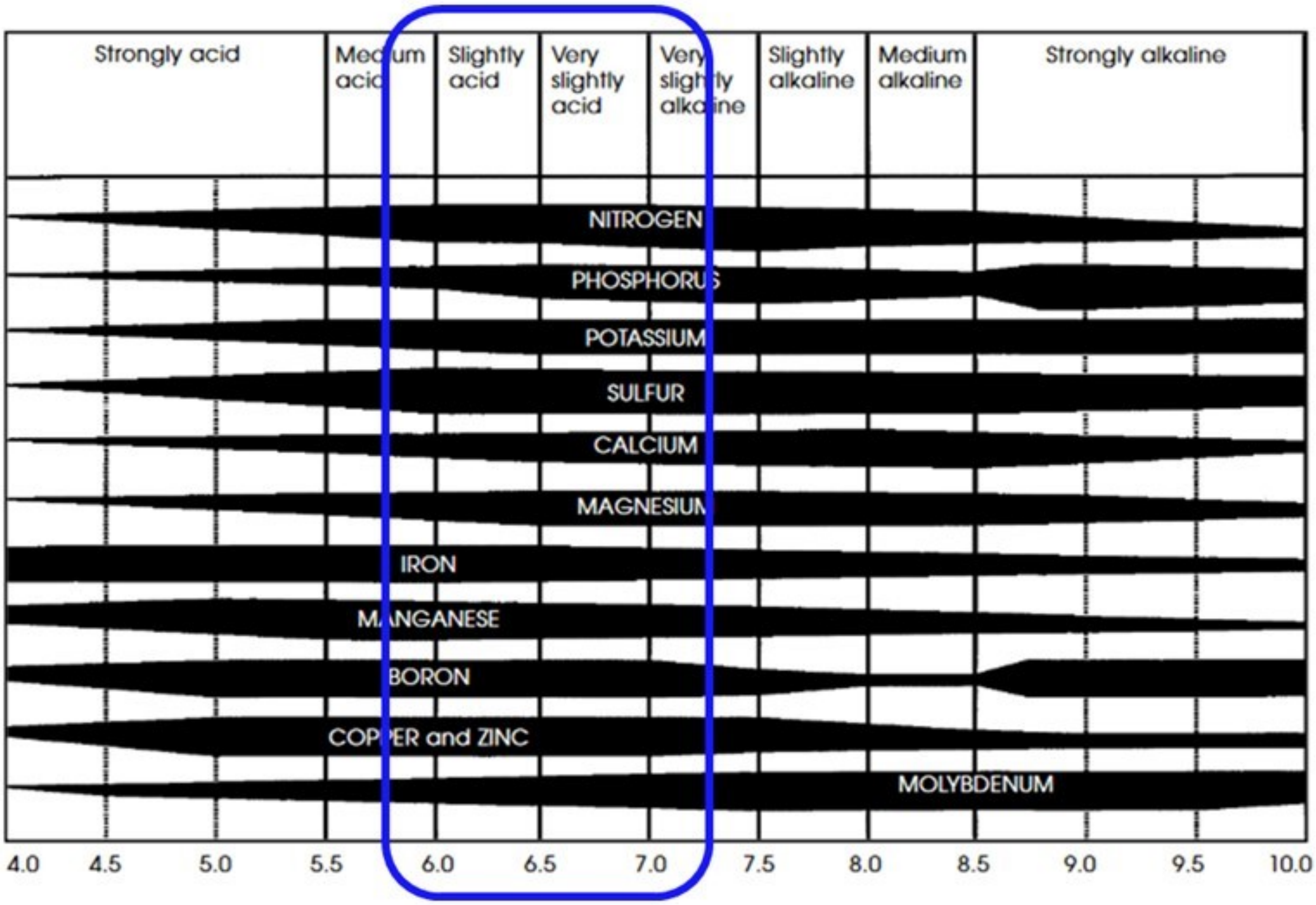

Figure 2. Impact of soil pH on soil nutrient availability to plants. The wider the band, the more plant available a given nutrient is. Maintaining soil pH between 6.0 and 7.0 optimizes essential plant nutrient availability (Figure courtesy NSW Dep. Primary Industries and Chris Teutsch)

The second thing to look at are the soil test P and potassium (K) values and where these fall in terms of their availability (very low to high) to corn and soybean. The rate is easiest to adjust, putting only what is needed where needed. If soil test P or K is in the very low to low range, then the probability of a yield response that will pay for the fertilizer is relatively good (Figure 3). If the P or K soil test level is in the upper medium to high range, the probability of a profitable yield response falls off.

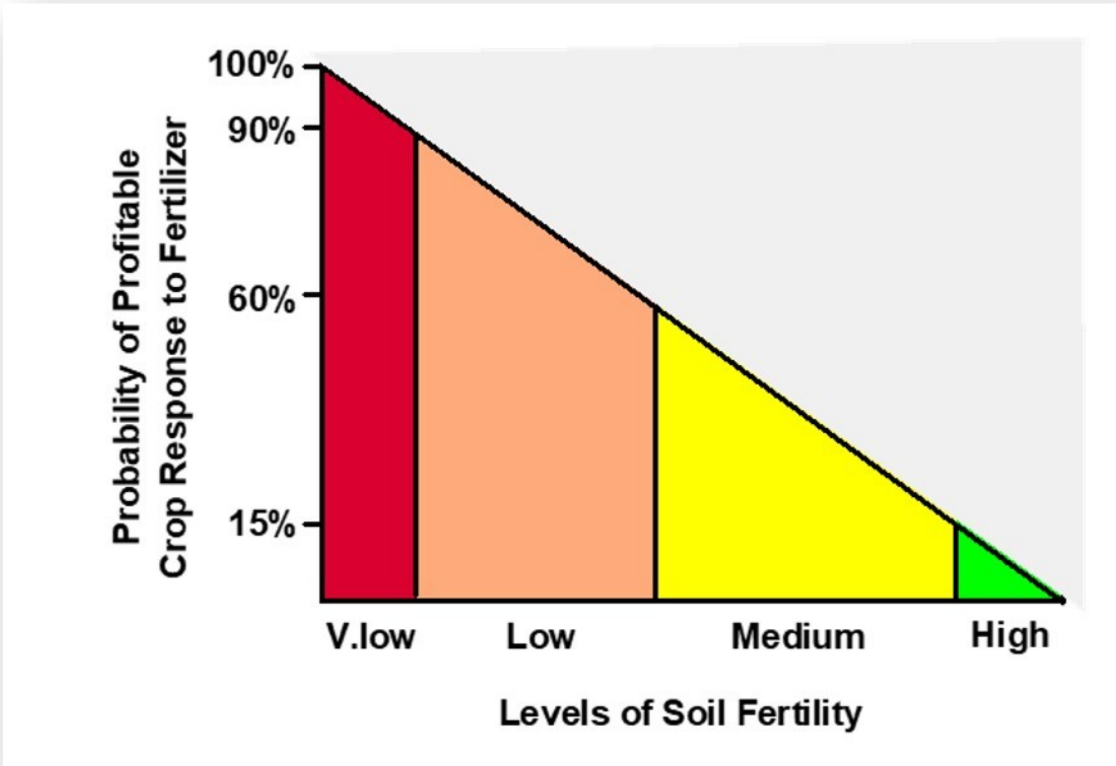

Figure 3. Likelihood of a profitable grain yield response to the recommended applied fertilizer rate as related to the initial soil test value (adapted from Havlin et al., 2005).

When the soil test P or K are in the high range, UK makes no fertilizer P or K recommendation. The UK fertilizer P and K rate recommendations at soil test P and K values in the upper portion of the medium range are not entirely intended for next year's crop. That added fertilizer is largely recommended to 'maintain' soil test P and K. An example is shown in Table 1, which gives recommended phosphate (P_2O_5) and potash (K_2O) rates for soybean according to soil test P and K values, respectively. The upper portion of the medium range (40 to 60 for soil test P and 242 to 300 for soil test K) is bounded in red. Maintenance fertilizer cannot always be afforded. Further, nutrients left in the 'soil bank account' are subject to physical loss and reduced plant availability – negative interest/return on investment (Thomas, 1989). So, if the field's soil test P and/or K values are in the upper medium to high range, our current advice is to forego recommended P or K fertilizer until prices moderate.

Table 1. Phosphate and potash rate (lb/acre) recommendations for soybean (from Table 15 in AGR-1, Ritchey and McGrath, 2020).

Category	Test Result: P	P_2O_5 Needed	Test Result: K	K_2O Needed
High	>60	0	>300	0
Medium	40 - 60	30	242 - 300	30
	34 - 39	40	226 - 241	40
	28 - 33	50	209 - 225	50
			191 - 208	60
Low	22 - 27	60	173 - 190	70
	16 - 21	70	155 - 172	80
	11 - 15	80	136 - 154	90
	9 - 10	90	118 - 135	100
	7 - 8	100	100 - 117	110
	6	110		
Very low	1 - 5	120	82 - 99	120
			64 - 81	130
			46 - 63	140
			<46	150

Time nutrient applications close enough to the period of greater crop nutrient demand. Generally, soluble nutrient sources, especially N, need to be 'on time' and neither too early nor too late. Too early and various nutrient losses should be expected. For example, fall applied DAP (18-46-0) will not provide much of an N benefit to the next corn crop, causing the P_2O_5 cost to rise from $0.52/lb to $0.78/lb, a 50% increase. Too late and the crops have advanced in their annual lifecycle such that they can no longer take advantage of the applied nutrients to rapidly increase growth and make best use of other resources (water, temperature, sunlight) as these are available. Optimal timing gives optimal economics – causes success when using the lower end of the recommended rate range.

Better timing can be combined with better nutrient placement. Sub-surface nutrient placement – banding – avoids physical (erosion/runoff) and chemical (fixation) losses in availability with nutrients like P and zinc (Zn). Banding can be done in a separate operation (usually strip-till) or at-planting. At-planting application as a 2 x 2 band allows total P_2O_5 and K_2O application rates to be reduced by 33 to 50%. Banding Zn causes the recommended rate to drop by 80% (Ritchey and McGrath, 2020).

In the absence of need, when soil test levels of all nutrients are adequate, at-planting supplementation (either in-furrow/pop-up or 2 x2) often does not result in a profitable yield response, especially when high-priced materials are used with in-furrow/pop-up protocols. The value of the planting time lost in filling/refilling at-planting fertilizer tanks can also be considerable, especially in wet spring planting seasons. UK research has shown that unless there is a particular need for Zn, a positive yield response occurs when P, and especially N, are deficient at planting. Consider replacing expensive in-furrow/pop-up liquid formulations with a simple APP plus UAN mix. You will get more nutrition for the same cost, or the same nutrition for less cost. If you need Zn, buy a compatible Zn-only product. Don't buy stuff you don't need.

Improved nutrient use efficiency occurs when the nutrient management plan is modified to consider current economics. Fertilizer nutrient rates, timing, placement, and sources are changed to better optimize profit for the investment in materials, equipment, and time.

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Blister Beetles in Soybeans in Kentucky

Blister beetles (Coleoptera: Meloidae) are insects that are found in soybean fields. Adult beetles feed in soybean foliage but do not cause economic damages. However, the larval stages are predators and beneficial insects. Female blister beetles lay egg masses in the soil near grasshopper eggs. Once blister beetle larvae hatch, they start to feed on the eggs of grasshoppers. Adults blister beetles have narrow bodies, and their length can be between 3/4 to 1-1/4 inch. Their head is broad compared with the thorax. The front wings are soft and flexible in contrast to the hard front wings of most beetle species. The antennae are approximately 1/3 the length of their entire bodies.

Blister beetles are known for the oily, caustic substance, that protect them from predators: cantharidin. In alfalfa, cantharidin can severely injure livestock (especially horses), if beetles are ingested with the hay, even when beetles are dead. Blister beetles cause irritations or blister in human skin. This happens when the beetle is pressed or rubbed against the skin.

There are several species of blister beetles in soybeans in Kentucky and they include the margined (*Epicauta funebris*) (Figure 1), ashgray (*Epicauta fabricii*) (Figure 2), striped (*E. vittata*) (Figures 3 and 4), and black (*E. pennsylvanica*).

Figure 1. Adult margined blister beetle, *Epicauta funebris* and feeding on soybeans.

Figure 2. Adult ashgray blister beetle, *Epicauta fabricii.*

Figure 3. Adult striped blister beetle, *Epicauta vittata*.

Figure 4. Lateral view of an adult striped blister beetle, *Epicauta vittata*.

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Useful Resources

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