WVU UPDATE

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Organic alternative may save honey bees

BY DAVID WELSH

WVU College of Agriculture, Forestry & Consumer Sciences

Mint and honey may not sound like the most appetizing combination, but, for an imperiled bee population, it could prove to be a lifesaver.

Robert Noel of Cumberland, Md., and James Amrine, professor of entomology at West Virginia University, have been exploring the use of wintergreen and other essential oils derived from plants as an organic pesticide. Their goal is control of the varroa mite, which Dr. Amrine describes as "the worst thing that has hit honey bees in 300 years."

The varroa mite (Varroa jacobsoni) has posed a serious problem for the beekeeping industry, wiping out entire commercial operations as well as feral, or wild, honey bee colonies. The mites reduce colony efficiency, shorten the life of worker bees, drastically reduce replacement of the adult honey bee population, and ultimately kill the colony.

Few chemical pesticides exist to combat the problem. Apistan (fluvalinate) is the only one registered for use in the United States. "The major problems with the fluvalinate are possible contamination of the hive and the fact that mites are becoming resistant to it," Amrine explained.

"Essential oils are probably a lot more effective and a lot more convenient to use, and harmless to the bees, and harmless to the people and plants" around them, Amrine said. "There are so many different kinds of essential oils, like wintergreen, spearmint, peppermint, rosemary, and melaleuca oils, and it appears that most of them can kill mites."

The essential oils, the researchers believe, act as a natural pesticide for the mites, killing them or adversely affecting the mites' ability to reproduce while leaving the honey bees unaffected.

Noel, a professional beekeeper in Cumberland, contacted Amrine about the potential mite remedy in July 1995. Noel had suffered substantial losses due to the varroa mite and was looking for an alternative to commercial pesticides. Noel began experimenting with the distilled oils of the plants, feeding them in sugar syrups to the bees. He met with surprising success. This spring, Noel developed the tracking strip as a treatment for varroa.

The essential oils, including wintergreen and patchouli, are combined with mineral oil and melted beeswax. The cooled, salve-like mixture is then spread on Plexiglas tracking strips and placed within the entrance of the colony. As bees enter and exit the hive, they pick up the oils, which then transfer to brood cells and to the parasitic mites.

"The day after the strips were applied, dead varroa mites were found on the tracking strips — several dead mites per colony," Amrine said.

Noel and a colleague, former Maryland bee inspector Harry Mallow, treated one of Mallow's hives with a tracking strip on May 31, 1996. By June 1, "both Harry and Bob observed several hundreds of dead varroa mites at the entrance, on and around the strip." Other experiments followed, each mirroring the success of the earlier attempts.

Other methods of application include feeding the bees the oil in a sugar syrup and placing grease patties containing the essential oils in the hives.

Many treated colonies are now in excellent health, with thousands of bees busy pollinating plants and producing large amounts of honey. Amrine said these are the best colonies he has seen in three years.

The researchers' current objective is to gather more data on the use of the oils to attempt to gain approval for their use as acaricides by the Food and Drug Administration and Environmental Protection Agency. Amrine is currently seeking out beekeepers in the region willing to participate in the research effort.

Amrine's concern for the honey bee population extends beyond commercial colonies. "We've had tremendous kill-offs of colonies and especially feral colonies... or wild bee colonies in bee trees. There used to be thousands of these feral colonies and most of them are now dead, gone, extinct," due to the varroa mites, Amrine said. In addition to the direct threat posed by the mites, honey bees have also been subjected to a connected viral syndrome either transmitted or activated by the mites.

To help publicize the ongoing study, Amrine is working with Patrick Porter, WVU Extension specialist in Integrated Pest Management, to develop a World Wide Web site on the process. The site will be part of the Extension Service's web pages (http://www.wvu.edu/~agexten/).

The researchers' future efforts will be directed toward discovering which oil is the most effective, at what levels the oils should be used, and what levels might harm honey bees. They'll also be looking to see whether the essential oils can be found in honey, beeswax, or propolis, the resinous material collected by honey bees from the buds of trees for use as cement in hive structures.

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West Virginia Bull Evaluation Program stands apart

BY WAYNE WAGNER

Livestock Specialist WVU Extension Service

In the market for a bull? Keep in mind some unique aspects of the West Virginia Bull Evaluation Program that set it apart from the typical bull test station.

Now in its 31st year, the comprehensive program is conducted by West Virginia University at its Reymann Memorial Farm in Wardensville. It culminates with the annual Total Performance Bull Sale, which this year is scheduled March 21. The sale will take place at the farm on State Rte. 259, two miles north of Wardensville.

The program is designed to provide the information that potential buyers need to evaluate the total merit of each bull in the sale. For example, it is important to have information on contemporaries when selecting and comparing bulls. To be contemporaries, bulls must be raised together and treated alike.

At Wardensville, no single consignments are accepted. Consignment groups for the 1997-98 program range from 3 to 30 head per consignor, with an average size of 6.5 head. This gives potential buyers the opportunity to evaluate consignor groups of cattle and select an individual within the consignor's group.

For several years, moderation in birth weight (BW) and birth weight expected progeny differences (BW EPD) has been emphasized in the program. Including BW EPD in the index has allowed lower birth weight bulls to be competitive. As a result, consigners have not been forced to breed just for more growth or frame in order to be competitive. The program is designed to allow consigners increased flexibility in their breeding programs to concentrate on traits that they consider important.

Much effort has gone into producing bulls with more muscle and excluding lighter muscled bulls from the sale. Each bull is evaluated by a team of trained graders from the West Virginia Department of Agriculture. The minimum score required for sale is a 2.9 or the upper 90% of the number 2 muscle score, which does allow some low birth weight bulls that are lighter muscled to qualify for the sale.

Bulls are also scanned for fat thickness, ribeye area, and percent intramuscular fat. Ribeye area is expressed in two ways. First, it is adjusted to 365 days of age. Secondly, it's expressed as ribeye area per 100 lbs. live weight in order to provide information on relative size.

Beginning in 1998, consignors to this program also will be required to consign to the West Virginia Feedlot and Product Information Program (or a similar program that provides individual feedlot performance and carcass data) at least as many cattle as they have entered in the bull evaluation program. This will direct more focus on the consignor's total animal merit, including quality and yield grade of herdmates, and may

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Bull Program *(Continued)*

push some consignors to become more conscientious of the end product.Although fertility in a broad sense is lowly heritable, most producers recognize that fertility is extremely important to the economics of a beef cattle-herd. A considerable amount of evidence indicates that within a breeding program, larger scrotal circumference at 365 days improves fertility. Therefore, scrotal circumference has also been included in the index and is measured on two consecutive days and averaged to improve accuracy.

Customer service is important in any business transaction. Among other things, transportation to central locations is provided at minimal cost both within and outside the boundaries of West Virginia.

Be sure to examine the sale catalog, available in advance at all WVU Extension Service county offices. You'll find that the bulls are very well described; in many cases, you do not have to see the cattle to understand what they look like. If you want, you can simply buy over the telephone and spend your time doing something other than traveling to and from a sale.

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Are those cows fit to breed?

By Wayne Wagner
Livestock Specialist, WVU Extension Service

It is well known in cattle circles that nutrition is highly related to fertility. It should come as no surprise then that body condition is also related to fertility, since body condition is a reflection of nutrition.

A system for scoring body condition, on a scale of 1 to 9, is shown in Table 1. Cattle producers can use this system to assess their herd before the upcoming breeding season.

A body condition score (BCS) of 5 to 7 is considered optimum for reproduction. A cow with a BCS of 7 probably has more condition than is necessary. It certainly would not be advisable to strive for a high percentage of cows in the herd to achieve this level of body condition. On the other hand, a BCS of 4 is considered borderline; it would not be advisable to maintain a high percentage of the cow herd in this condition.

Results of a study from Colorado State University are shown in Table 2. Body condition scores ranged from 3 to 7, and cow age ranged from 2 to 10 years. Cows were synchronized and bred by artificial insemination (AI) and then exposed to a clean-up bull. Cows with a BCS of 5, 6, or 7 showed a greater response to synchronization than cows with a BCS of 3 or 4. Likewise, cows with a BCS of 5, 6, or 7 had a higher conception rate among those that responded to synchronization and a higher conception rate after 25 and 60 days of breeding than did cows with a BCS of 3 or 4.

These data suggest that body condition has an important effect on the percentage of cows that will exhibit heat early in the breeding season. This is extremely important to the producer using an AI program as well as to the commercial producer who attempts to have a high percentage of calves born in the first 25 days of the calving season.

Body condition also has an important effect on pregnancy rates. After 25 days, 62.5% of cows with a BCS of 4 were pregnant compared to 93.3% of cows with a BCS of 6. After 60 days, pregnancy rates were 73.3, 79.5, 84.2, 97.7, and 100% for cows with BCS of 3, 4, 5, 6, and 7 respectively.

As a producer, evaluate the body condition of your cows. If a high percentage have a BCS of 5 or above, you should experience good conception rates this spring. However, those with a BCS of 4 or less will probably breed later and have a lower conception rate. Now is the time to adjust feed conditions for those cows. If you have not done so already, you may need to separate these cows from the rest of the herd so they can be better managed and fed.

If you have a high percentage of your cows in a body condition of 4 or less, you should consider the following:

(1) Increase the quantity and perhaps quality of feed being given to the cow herd.

(2) If item #1 is impossible or too costly to implement, decrease frame size and/or genetic level of milk production in your herd to better match your cattle to the environment.

Under normal conditions, you should be able to maintain the cow herd on hay that you produce. Supplemental feed may be necessary for 2-year-olds and yearling heifers.

When the cow herd requires supplemental feed, your cows are not matched to your environment. Like so many things in agriculture, we must strive to find the optimum to maximize profit.

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Table 1: Body Condition Scores (BCS) for Beef Cattle

Group	BCS	Description
Thin Condition	1	EMACIATED - Cow is extremely emaciated with no palpable fat detectable over spinous processes, hip bones or ribs. Tail-head and ribs project quite prominently.
	2	POOR - Cow still appears somewhat emaciated but tail-head and ribs are less prominent. Individual spinous processes are still rather sharp to the touch but some tissue cover exists along the spine.
	3	THIN - Ribs are still individually identifiable but not quite as sharp to the touch. There is obvious palpable fat along spine and over tail-head with some tissue cover over dorsal portion of ribs.
Borderline Condition	4	BORDERLINE - Individual ribs are no longer visually obvious. The spinous processes can be identified individually on palpation but feel rounded rather than sharp. Some fat cover over ribs, transverse processes and hip bones.
Optimum Moderate Condition	5	MODERATE - Cow has generally good overall appearance. Upon palpation, fat cover over ribs feels spongy and areas on either side of tail-head now have palpable fat cover.
	6	HIGH MODERATE - Firm pressure now needs to be applied to feel spinous processes. A high degree of fat is palpable over ribs and around tail-head.
	7	GOOD - Cow appears fleshy and obviously carries considerable fat. Very spongy fat cover over ribs and around tail-head. In fact "rounds" or "pones" beginning to be obvious. Some fat around vulva and in crotch.
Fat Condition	8	FAT - Cow very fleshy and over-conditioned. Spinous processes almost impossible to palpate. Cow has large fat deposits over ribs, around tail-head and below vulva. "Rounds" or "pones" are obvious.
	9	EXTREMELY FAT - Cow obviously extremely wasty and patchy and looks blocky. Tail-head and hips buried in fatty tissue and "rounds" or "pones" of fat are protruding. Bone structure no longer visible and barely palpable. Animal's motility may even be impaired by large fatty deposits.

Table 2: Effect of Body Condition Score on Estrous Response and Pregnancy Rate in Beef Cows [ab]

Body Condition Score[c]	Number of Cows	Response to Synchronized Treatment, %[d]	Synchronized Conception Rate, %[e]	25 Day Pregnancy Rate, %[f]
3	15	20.0	66.7	53.3
4	88	32.9	62.1	62.5
5	38	60.5	91.3	76.3
6	45	75.5	91.2	93.3
7	9	66.6	66.7	77.7

[a] Source = Colorado State University
[b] Cows age 2 to 10
[c] 1 = very thin; 5 = moderate; 9 = very fat
[d] Number in estrus in 5 days after treatment divided by number in group.
[e] Number conceived after treatment divided by number bred.
[f] Number pregnant in 25 days after treatment divided by number in group.

Transgenic crops yield new recipes for insect control

By Patrick Porter
Integrated Pest Management Coordinator
WVU Extension Service

Transgenic technology has introduced new varieties of corn, potatoes and other crops that offer a distinct advantage: They make their own insecticide.

These new varieties are the result of advancements in molecular biology that have allowed scientists to remove specific genes from one type of organism and place them into different organisms. This is a difficult process, but it is easy to understand the net results.

Genes are essentially instructions that, when read and followed, allow an organism to construct its basic parts from available molecules. In a way, genes are like recipes; they tell which molecules to combine—and in what order to combine them—to make a specific product. If a certain recipe is followed, a specific product will result. Every organism has a specific set of genes, but, of course, different species have different sets.

Following the recipe analogy, different species have different cookbooks. Some recipes are the same in all of the cookbooks, some are different, and many existing recipes are not in a particular species' cookbook at all. For example, plants have genes which instruct them to make chlorophyll, the substance that gathers sunlight and converts it into sugars. Animals do not have genes for chlorophyll, and hence they cannot convert sunlight into sugar.

Molecular biologists now can extract genes from one organism and put them into other organisms, much like removing a recipe from one species' cookbook and placing it into another species' cookbook. Transgenic crops are the first practical application of this ability.

The insecticide that transgenic crops make is derived from Bacillus thuringiensis (Bt), a bacterium that makes a protein that is toxic to some insects. This is nothing new; the bacteria and their toxic proteins have been around for millions of years. In fact, scientists have cultured these bacteria, and they have been used in spray-on insecticides for more than 40 years.

What is new is that scientists extracted the gene that tells the bacterium how to make the toxic protein, and they put it into the gene suite of several plants. These plants now have the bacterium's "recipe" for how to produce the toxin. Commercial varieties of transgenic cotton, corn, potatoes, and sweet corn are now available to farmers.

When a susceptible insect eats plant tissue where the toxic protein is being produced, it receives a dose of toxin. In the past, farmers applied Bt pesticides to crops at a known rate of toxin units per acre. The number of toxin units per ounce was listed on the insecticide bottle, and these were applied as a "field rate." The new transgenic crops contain much more Bt toxin than Bt insecticide applied through a sprayer. Insects feeding on transgenic corn, for example, will eat a dose that is 30 to 90 times higher than would have been eaten on a corn plant sprayed with Bt insecticide from a bottle.

It is important to remember that transgenic crops, while they contain relatively high amounts of Bt toxin, are still ineffective at controlling many pests. This is primarily because Bt is only toxic to a few pests, no matter how much is present in the plant. For instance, the European corn borer (a major pest of corn) is susceptible to Bt and will be killed by transgenic corn. However, the Bt toxin in current varieties of transgenic corn is not toxic to corn rootworm beetles. These beetles can consume vast quantities of this corn with no ill effects.

Transgenic crops will not solve all pest problems, and farmers must continue to monitor their crops and use appropriate control measures where warranted.

Scientists have identified many different Bt toxins, but current Bt transgenic crops have only one type. Future transgenic crop varieties will contain different toxins and be effective on a broader range of pests.

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New crop varieties can withstand war on weeds

By John Hinz
Crop and Weed Science Specialist
WVU Extension Service

Several herbicide-tolerant crops have been introduced to the market recently, and more are on the way.

These new products broaden the options for farmers making spring planting decisions. The following information may help to clarify the choices and considerations involved.

Herbicides that can be sprayed on herbicide tolerant crops.

Crop / Herbicide	IT/IR corn	Liberty-Link corn	Roundup Ready Corn	Roundup Ready soybeans	Poast Protected corn
Pursuit	yes	no	no	yes	no
Contour	yes	no	no	no	no
Resolve	yes	no	no	no	no
Lightning	yes	no	no	no	no
Roundup	no	no	yes	yes	no
Liberty	no	yes	no	no	no
Poast	no	no	no	no	yes
Normal hebicides registered for that crop	yes	yes	yes	yes	yes

The first herbicide-tolerant crop was imidazolinone-tolerant corn, also known as imi-corn. These hybrids allow the application of Pursuit and Pursuit-based tank mixes to corn. Some imi-corns also are tolerant to the herbicide family sulfonylurea, another family of herbicides that act at the same enzyme as the imidazolinone herbicide family.

Sulfonylurea herbicides labeled in corn include Accent, Beacon, Exceed, and Permit. However, you do not need to plant imi-corn to use these herbicides in corn. If you plant continuous corn and use an organophosphate soil insecticide such as Counter, and need to apply Accent, Beacon, Basis, Basis Gold, Broadstrike/Dual, Exceed or Python, you may want to consider planting an imi-corn that is tolerant to the sulfonylureas.

Accent, Beacon, and Exceed have been shown to interact with organophosphate insecticides and result in increased injury to the corn. These imi-corns can eliminate the increased injury from the sulfonylurea and organophosphate interaction. Please consult the herbicide label for specific information about this interaction.

Poast-tolerant corn is also available. Poast Protected corn, formerly SR corn or sethoxydim (the chemical name for Poast) resistant corn allows the application of Poast Plus to corn. Poast Plus kills only grass weeds and has no effect on broadleaf weeds. It can be used against some of the hard-to-control grass weeds. Do not apply Assure II, Fusilade DX, Fusion, Option II, or Select to SR corn because crop injury can result.

Liberty-link corn is available. Liberty is a new nonselective (kills everything) herbicide that can only be used with Liberty-link varieties. Liberty is effective on annual grass and broadleaf weeds. Liberty will kill non-Liberty-link varieties.

Sulfonylurea tolerant soybeans (STS) allow applications of Classic and Pinnacle herbicide at rates higher than could normally be applied to non-STS soybeans without crop injury. Classic and Pinnacle are specifically prepacked as Synchrony STS for STS soybeans. STS does not protect soybeans from Pursuit injury or injury when Pursuit and Pinnacle are tank mixed. Avoid mixing Pursuit and Pinnacle.

Roundup is a nonselective herbicide that has been around for a number of years. Many of you may have used it in the past and know its performance. Roundup can be applied only on Roundup-Ready soybeans and corn, as it will kill non-Roundup-Ready soybeans and corn.

Roundup-Ready soybeans are currently available from many companies; however, Dekalb is the only seed company that will have Roundup-Ready corn in 1998.

Companies have different agreements with Monsanto, the manufacturer of Roundup. Most companies require that a technology fee be paid to Monsanto for Roundup-Ready soybeans. Pioneer Hybrid International does not have this agreement with Monsanto, and you are not required to pay the technology fee. A technology fee will also be charged for Roundup-Ready corn. Whatever the case, make sure you take into account the cost of the technology fee when deciding which variety and herbicide you will use.

These new herbicide-resistant crops are exciting technological advances in weed management. Remember that herbicides are another tool in the fight against weeds. Use integrated weed management techniques such as tillage, crop rotation, proper planting date, and row spacing to help combat weeds.

Be aware of other factors when selecting the proper hybrids/varieties. Don't sacrifice disease tolerance or yield potential when you select a hybrid or variety. Also, make sure the hybrid or variety is of the proper maturity range for your farm.

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Management key to no-till seeding success

By Edward B. Rayburn
Forage Agronomist, WVU Extension Service

Properly managing a no-till seeding before, during, and after establishment pays off. With the right management, you can increase forage production and quality in a cost-effective manner with little risk of soil erosion from hilly ground.

What management considerations are needed in establishing a no-till seeding? These points can be used as a checklist for successful seedings. For more information, contact your county's WVU Extension Service office and ask for detailed fact sheets.

- Correct soil fertility and pH. Have your soil tested, and apply the proper rates of phosphorus, potassium, and lime to meet the needs of the new seeding. For spring seedings, fertilizer and lime should have been applied the previous fall since it is difficult to get lime trucks out on wet fields in the spring
- Select the appropriate forage species for your conditions. Choose the mixture of species best adapted to the soil drainage and management to be used in the field. Improperly matching the plants to the soil and management could result in the untimely death of the seeding.

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- Control plant competition. There are two types of competition to a no-till seeding: perennial weeds and desirable forage grasses. For a no-till seeding, perennial weeds should be identified and killed with the appropriate herbicides long enough before the new seeding to meet herbicide label restrictions. Save desirable forage grasses by using a burn-down herbicide, which will reduce their competition but not kill them. You can kill undesirable forage grasses with approved systemic herbicides.
- Seed at proper rate and depth, maintaining good seed-soil contact. Use "blue-label" certified seed of proven varieties to ensure clean seed with known performance. Seed at the proper rate and depth. It is critical that the no-till seeder be adjusted properly. Adjust the disk openers so that cool-season grasses and legumes are seeded 1/4- to _-inch deep. Adjust the press wheel for adequate pressure to ensure proper firming of the soil to get good seed-soil contact.
- Manage grazing and mechanical harvest to maintain the desired plant species. The main reason no-till seedings are lost is that they are not grazed or harvested properly after establishment. Graze or harvest the field at the appropriate timing and intensity for the forage mixture seeded. Remember that before renovation, a pasture is in balance with the soil fertility and grazing management used. Without changing the grazing or fertility management, a new seeding will only revert back to what was there before.
- Manage soil fertility to maintain forage production. Apply fertilizers to replace the plant nutrients removed in the harvested forage. These fertilizers can be home-grown manure or purchased fertilizers and lime.

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Get the most from your soil test report

By Devinder K. Bhumbla
Soil and Water Specialist WVU Extension Service

The West Virginia University Soil Test Report is an important tool in making fertilizer and lime application decisions for field crops and forage production. To get the most from this tool, make sure you understand the soil test report.

Soil testing consists of three steps: a) soil sampling; b) laboratory analysis; and c) interpretation of results and recommendations for soil fertility management. Improper soil sampling and limited information about field history and intended use of the soil test may severely limit the usefulness of a soil test report.

The most important step in using a soil test is to make sure that the soil sample that you collect truly represents the field. Instructions for collecting a representative soil sample are given on the back of the questionnaire that is a part of the WVU soil test kit. These instructions on soil sampling also are provided in a fact sheet titled "How to Take a Good Soil Sample." This fact sheet answers questions about time, method, depth, and frequency of soil sampling.

The first part of the soil test report identifies the sample by field name or number, field size, soil texture, tillage method, liming history, and previous crop in the field. This information is taken from the questionnaire that the farmer fills out and submits with the soil sample. Also included in the questionnaire is the crop for which fertilizer recommendations are needed. It is important to have the information about previous liming and cropping history of the field for making correct interpretation of soil test values.

The second part of the soil test report contains information on soil test results. The regular soil test includes information on soil pH, phosphorus, potassium, calcium, magnesium, cation exchange capacity, base saturation, and lime requirement. The micronutrients zinc, copper, and manganese are also analyzed upon request.

In addition to the numerical values for the nutrients (P, K, Ca, and Mg), soil test values are classified into low, medium, high, and very high categories. Here's what each level means:

Low— A nutrient or pH level listed as low has a high probability of limiting plant growth and yield. A recommendation will be made to substantially increase the soil level of that component. If the level is very low, several years of corrective fertilizing or liming may be needed, monitored by yearly soil testing.

Medium— A nutrient or pH level listed as "medium" may be adequate for some low- demand crops. This is taken into account in the recommendation for those specific crops. A medium level may limit plant growth or yield by the end of the growing season in years of very good growing conditions. There can be many soil types in which a nutrient testing "medium" may not meet crop nutrient requirements. Corrective fertilizing or liming is usually recommended in moderate amounts to cause a slight increase in soil level after the crop has been harvested or to support exceptional yields in a very good year.

High— A nutrient or pH listed as "high" is theoretically ideal to support plant growth and maximum yield. Corrective fertilizing is not recommended. Any amendments or fertilizers applied for a soil test component listed as "high" are to compensate for crop removal. A small amount of starter fertilizer containing the nutrient may also be recommended.

Very high — A level listed as very high for a plant nutrient may indicate levels higher than those needed to support optimum crop growth and production. Growth and yield may be inhibited by the soil nutrient that is testing in the very high range, either because of direct toxic effects or because excess of one nutrient may interfere with the uptake or availability of others. Additional application of a nutrient testing in the excessive level will only increase the likelihood of reduced yield. One exception is the optional application of a very small amount

of starter phosphorus on corn to compensate for cold soils in the spring. Crop removal and other natural losses over time should eventually reduce the nutrient levels to a "high" range. However, some reports suggest that once a soil tests very high in phosphorus it may be many years before it will again respond to phosphorus application.

Soil pH is an indicator of the acidity or alkalinity of a soil sample. A pH below 7.0 is acidic and pH above 7.0 is alkaline. Low soil pH is an indicator of acidity, but does not by itself predict lime requirement. Also, pH is a master variable that controls the availability of most plant nutrients. Different crops require different soil pH levels for best growth and optimum production in terms of yield and economic costs.

For most crops, optimum pH levels are between 6.0 and 7.0. Many row crops, small grains, and grass legume mixtures should be maintained in soils with pH between 6.1 and 6.6. Alfalfa requires a slightly higher soil pH of 6.6 to 7.0. Many pure grass stands do well with a pH of 5.5 to 6.0. Crop production may be severely reduced in soils with a pH at or below 5.0. As soil pH falls below 5.0, aluminum and manganese may increase to toxic levels. Also, phosphorus and molybdenum availability decreases as soil becomes more acid.

Pounds per acre extractable phosphorus (P) is an index for determining phosphorus availability. The high level for P for most crops is 50 to 80 pounds per acre. Soils testing high in P are not likely to produce economic yield increases with an application of additional phosphorus. When soils test in the high range, applying only a small quantity of phosphorus is suggested to maintain high fertility status. There is no economic benefit to applying phosphorus to soils testing very high in P.

Pounds per acre extractable potassium (K), Calcium (Ca), and Magnesium (Mg) is an index for determining the availability of these three nutrients over the next growing season. The ratings of potassium soil test levels are similar to those made for phosphorus.

Very low to low soil K levels strongly indicate that crop will respond to K. Band application of a portion of the total requirement may also be advantageous. Medium soil test K levels indicate that a crop may respond to potassium application if climatic conditions are favorable. Soils with high soil test K levels are not likely to respond to fertilizer application, but fertilizer may be applied to replace crop removals. Fertilizer application to soils testing high in K will maintain high fertility levels of the soil. Very high soil test K shows that you can allow crops to deplete K until soil test drops into the high range.

Low calcium and magnesium are often associated with soils testing low in pH. Liming is recommended to supply these two nutrients. Magnesium is recommended if the present soil test levels is below 10% saturation of the cation exchange capacity of a soil . The most common and most economic source of magnesium is dolomitic limestone.

Quite often when lime is not needed, no magnesium recommendation is made. Cases of acute magnesium deficiency in crops are quite rare, and the cost of other sources of this nutrient is often prohibitive. In most cases, it is acceptable to wait until lime is needed again and then apply a magnesium lime (dolomitic). Where forage is grown on low- magnesium soils, the cattle must be fed a magnesium-containing mineral mixture.

Lime requirement (LR) is determined by a buffer pH value. Limestone recommendations are made to correct the problem of soil acidity. The lime requirement determines the amount of ground limestone that should be added to a soil to raise its pH to 6.5.

The last part of the soil test report contains "recommendations to landowner for agricultural limestone and fertilizers." These recommendations are based on soil test values, previous cropping history of the field, yield goals, and estimated nutrient removal by crops. Recommendations are made for agricultural limestone, nitrogen , phosphorus, and potassium. Agricultural limestone recommendations are in tons/acre of calcitic limestone required for pH correction.

Remember, recommendations for nitrogen fertilizers are based not on soil testing but on expected crop removals and fertilizer use efficiency.

Phosphorus and potassium recommendations are based on soil testing. Recommendations for these nutrients are given in lbs/acre of P2O5 and K2O. It's important to understand recommendations made are not in terms of pounds of fertilizer that should be added to a given field. You will have to calculate the amounts based on that fertilizer's nutrient analysis.

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The West Virginia University Extension Service and the WVU College of Agriculture, Forestry and Consumer Sciences are pleased to offer this educational insert to the Farm Bureau NEWS as a service to West Virginians. We welcome your questions or comments.

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