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Update in Weed Management 2009 - Has the Silver Bullet Been Developed?

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Update in weed management 2009 – has the silver bullet been developed?
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Introduction
The short answer to the question posed in the title of this paper is an unqualified and emphatic no! While there are new technologies, herbicides and formulations available, they represent only additional tools that will be helpful in implementing a successful weed management program. An emphasis must be placed on the “helpful” and “management”, neither of which meets grower desires for simple, convenient, and cheap weed control tactics. While the glyphosate based systems are generally successful (still) in killing weeds (see “Is there a reason to consider stewardship or is killing weeds good enough?” which appears in this proceedings), there is no longer a question as to whether or not the system is beginning to weaken and problems are exhibiting themselves. In fact, more complaints concerning the performance of glyphosate on a number of weeds are received at an increasing rate. Thus, it is critically important to review the tools that are available and design the most effective and diversified weed management program possible. While this effort will require more thought and consideration than growers and AgChem professionals have become accustomed, it will pay dividends in the long term, both with regard to minimizing changes in the weed community and improving profitability. Silver bullets for weed management have never existed. This paper will describe a number of new technologies from a number of companies; not all companies or all technologies will be covered. The inclusion of a technology should not be construed as an endorsement or the exclusion suggests that the technology is not acceptable.

Aceto Agricultural Chemicals Corp
Halomax 75 will be registered for post-emergence application in corn. Halomax 75 is similar to Permit 75WG, formulated as a WDG (wetable dry granule) and contains 75% halosulfuron as the active ingredient. Halomax 75 control yellow nutsedge and has activity on common ragweed, giant ragweed, pigweed species, and velvetleaf. However, Halomax 75 is an ALS inhibitor herbicide and does not effectively control ALS resistant weed biotypes.

AMVAC
AMVAC has a supplemental label for Impact® herbicide in field corn, popcorn and sweet corn. The supplemental label allows a maximum application of 1.0 fluid ounce per acre, either as a single or sequential treatment. Do not apply Impact within 45 days of corn harvest or graze or feed treated corn forage, silage, fodder or grain within 45 days after application. With the 1.0 fluid ounce rate, there are rotational restrictions of nine months for alfalfa and sorghum, and an 18 month rotational restriction for soybeans in Iowa. Soybean rotation intervals for 0.5 and 0.75 fluid ounces per acre remain unchanged.
Impact® is registered for aerial application and is not restricted to stage of corn development (refer to harvest and feeding restrictions listed above). There was interest in applying Impact® by aircraft during the 2008 growing season due to adverse conditions that precluded ground applications.
However, aerial application is not advisable given the mechanism of action (inhibition of plant pigments - “bleaching”), the relative sensitivity of non-target plants (i.e. soybeans), and the high drift potential from aerial applications.

**BASF**

BASF Crop Protection is developing a new herbicide technology they have named Kixor™. While not currently registered, the registration dossier has been submitted and registration is expected during the third quarter 2009. Kixor™ is described as a highly effective herbicide with contact and residual activity preemergence in a number of cropping systems. This product demonstrates activity on a number of broadleaf weeds including those that have evolved resistance to glyphosate, ALS and triazine herbicides. Thus far, the new technology has demonstrated favorable environmental, toxicological, and ecotoxicological profiles. A number of formulations are anticipated.

Distinct® is now registered as a burndown herbicide for soybeans. Apply two to four ounces per acres to control emerged broadleaf weeds at least 30 days prior to soybean planting. Another restriction describes the need for a minimum of one inch of rainfall or overhead irrigation prior to soybean planting. Other changes in BASF Crop Protection include the registration of Status® on popcorn (apply five to ten ounces per acre when popcorn is four to 36 inches tall at least 15 days prior to tassel emergence), Prowl H₂O on asparagus and several brassica crops, and the discontinuation of Marksman® and Celebrity Plus®.

**Bayer CropScience**

Balance Flexx® is a new formulation of isoxaflutole (previously marketed as Balance Pro®) for corn that includes the proprietary safener Cyprosulfamide (Crop Safety Innovation (CSI) Safener™). The safener enhances the metabolism of the isoxaflutole in the crop while maintaining highly effective weed control. Balance Flexx® will be registered for preplant (surface or incorporated), preemergence and postemergence application (up to the V2 stage of corn) and will provide excellent activity on a number of weeds including weeds that have evolved resistance to ALS, triazine and glyphosate herbicides. A number of tankmix combinations are described on the label which is anticipated early in 2009.

Another new “product” that is currently under EPA review is Corvus™ Herbicide. While not currently registered, it is anticipated that this prepackage mixture of isoxaflutole plus thienarbazone-methyl and their proprietary crop safener (CSI) cyprosulfamide will be available in 2009. Isoxaflutole is an HPPD inhibitor herbicide while thienarbazone-methyl is an ALS inhibitor herbicide. The Corvus™ Herbicide formulation will be a suspension concentrate which includes 0.75 pounds active ingredient thienarbazone-methyl and 1.88 pounds active ingredient isoxaflutole for a total of 2.63 pounds active ingredients of herbicide per gallon of formulated product. The formulated product also includes 1.25 pounds per gallon cyprosulfamide. Corvus™ Herbicide will be registered for field corn and popcorn and sweet corn will not be included on the anticipated label. The label has cautionary statements that suggest corn hybrids and certain male pollinators within blended corn varieties vary in their sensitivity to Corvus™ Herbicide. Replanting restrictions specify that only field corn can be replanted within the growing season after Corvus™ Herbicide application. It is anticipated that Corvus™ Herbicide will be registered for post-harvest applications in the fall or
early spring, preplant surface-applied, preplant incorporated, preplant/preemergence burndown, preemergence and early postemergence applications. Restrictions for the use of organophosphate and carbamate insecticides will be included in the label. No aerial application is allowed. Control of a number of economically important annual grasses, broadleaf and winter annual weeds will be described on the anticipated label.

Ignite® 280 SL Herbicide will replace Liberty® for use in Liberty Link® corn and soybean cultivars and can also be used in conventional and transgenic varieties of corn and soybeans as a broadcast burndown prior to planting or emergence of the crop. Ignite® 280 SL Herbicide should be applied from emergence of Liberty Link® corn through the fifth leaf (V5) at 22 ounces per acre. Do not apply more than 44 ounces per acre of Ignite® 280 SL Herbicide on corn per growing season. In Liberty Link® soybeans, applications can be made from emergence up to but not including bloom. For both crops, do not apply more than two applications per season and sequential applications should be at least 10-14 days apart. Ignite® 280 SL Herbicide applied at 22 ounces per acre is the equivalent amount of 30.7 ounces of Liberty®. The addition of 3 pounds of ammonium sulfate per acre is required for Ignite® 280 SL Herbicide application to Liberty Link® corn. Refer to the Ignite® 280 SL Herbicide for other restrictions and application requirements.

Laudis™ (tembotrione) was introduced for commercial use for weed control in corn in 2008 and demonstrated excellent weed control and crop safety. Laudis™ is an HPPD inhibitor herbicide (bleacher) with relatively high specific activity on sensitive plant species. As such, the movement of Laudis™ to non-target areas was readily observed in 2008. Injury in soybeans in isolated situations was relatively widespread in fields to the extent that the potential for the volatilization of Laudis™ was questioned. The evidence is good that the formulation of tembotrione does not volatilize; data suggest that other HPPD inhibitor herbicide have a higher vapor pressure than Laudis™ but are not subject to concerns for volatilization. As a comparison, Laudis™ has a vapor pressure five to six-fold (100,000 to 1,000,000 X) less than dicamba (Banvel® formulation). However, these physicochemical properties do not fully explain the injury to soybeans that was observed in isolated instances in 2008.

When the potential for drift is considered, aside from the environmental conditions that occurred during application, the other factor that must be considered is the relative sensitivity of the non-target plant species. Anecdotal evidence suggests that soybeans are more sensitive to Laudis™ than either Impact® or Callisto®. Thus it requires less Laudis™ to drift and cause significant symptoms in soybeans. Importantly, Laudis™ is no more prone to drift than any other herbicide. However, while the actual amount of tembotrione moving was quite low, the result was obvious symptoms of HPPD herbicide injury. The point is that an extremely low amount of Laudis™ might move a longer distance (thus suggesting volatilization) and cause injury to soybeans because of the high relative sensitivity of the soybeans to Laudis™. However, the evidence is clear that Laudis™ does not volatilize, but small amounts that can drift a relatively long distance and can cause obvious injury to sensitive species. Thus the onus is on the applicator to make sure that drift does not occur and that spray tank contamination is eliminated.

In 2009, Liberty Link® soybean varieties will be introduced for limited commercial use. Liberty Link® soybean varieties will allow the topical application of the non-selective, non-residual herbicide Ignite® 280 SL Herbicide and will provide an alternative strategy for the control of a broad spectrum of weeds, and ALS, triazine, and glyphosate resistant weeds, specifically. The use tactics for Ignite® 280 SL Herbicide have been described previously in this paper. It is important
to recognize the strengths and limitations of this alternative system for weed control. While Ignite® 280 SL Herbicide controls a great number of grass and broadleaf weeds in Liberty Link® soybean, the active herbicide ingredient in Ignite® 280 SL Herbicide does not translocate like glyphosate. Thus, application timing is more critical in order to control weeds when they are relatively small. Furthermore, the control of perennial weeds is not the strength of Ignite® 280 SL Herbicide compared to glyphosate.

However, it must be recognized that the objective of herbicide use is not to control weeds but rather to protect potential crop yield. Thus strictly from the economic perspective, application timing for Ignite® 280 SL Herbicide and glyphosate are similar; these herbicides should be applied earlier than later in order to most effectively protect potential crop yield as well as consistently control a broad spectrum of weeds. With regard to helping manage herbicide resistant weeds, Ignite® 280 SL Herbicide provides another excellent tool and will help manage ALS, triazine and glyphosate resistant weed populations as long as glufosinate has activity on the target weed species. However, the recurrent use of Ignite® 280 SL Herbicide will impose selection pressure on the weed community ultimately resulting in weed populations that are not effectively controlled by glufosinate, whether the result of evolved resistance or shifts to naturally tolerant species. Stewardship of Liberty Link® and Ignite® 280 SL Herbicide must be an immediate consideration when these technologies are adopted by growers.

**DuPont**

DuPont is developing a new postemergence herbicide with residual activity for non-crop markets, pasture and rangeland. The new herbicide will control a broad spectrum of broadleaf weeds and the label has been submitted with first registration anticipated in 2010. The new product is classified as a hormone mode of action.

New products for DuPont include Accent® Q and Steadfast® Q. These products are similar to Accent® and Steadfast® but include a safener. Federal labels have been approved and state labels are pending. Prequel® (rimsulfuron plus isoxaflutole) label has been submitted. There are no changes on the Canopy® EX, Canopy®, Envive™, Enlite™, and Synchrony® XP labels for 2009.

Resolve® Q is a multipack combination of thifensulfuron, rimsulfuron and a safener. It will be positioned as a tankmix partner with glyphosate in glyphosate resistant corn and will provide some residual control of sensitive weeds. However, given that Resolve® Q is a combination of ALS inhibitor herbicides, ALS resistant weeds that have also demonstrated resistance to glyphosate (i.e. common waterhemp) will not be controlled. Apply 1.25 ounces of Resolve® Q per acre in combination with glyphosate and 0.75 pounds atrazine per acre to glyphosate resistant corn up to 20 inches tall or up to and including six leaf collars, whichever is more restrictive.

Require™ Q is a multipack combination of rimsulfuron, dicamba and a safener, and will be positioned as a tankmix partner with glyphosate in glyphosate resistant corn. Require™ Q will provide improved broadleaf weed control and some residual grass control. The dicamba in the multipack should help control ALS and glyphosate resistant weeds. The application of Require™ Q should be delayed until corn reaches four inches in height or V2. Do not apply to corn that exhibits seven leaf collars or is taller than 20 inches, whichever is more restrictive.

The introduction of Optimum® GAT® technology for soybeans has been delayed until 2011,
pending US regulatory approvals and field testing. The delayed introduction of Optimum® GAT® soybeans is due to an effort by DuPont and Pioneer to utilize more effective technologies available and introduce the traits into new elite germplasm. Optimum® GAT® technology for corn continues on schedule with an anticipated commercialization of 2010.

**FMC**

FMC has a number of label additions and new products for 2009. Authority® Assist (sulfentrazone and imazethapyr) will be positioned as a preemergence product in Roundup Ready® soybeans in an effort to supplement and steward glyphosate. Authority® Assist will provide some residual control of small seeded annual broadleaf weeds and grasses. Applications can be made early preplant (up to 45 days prior to planting) and preemergence until three days after planting. Early preplant applications should use the highest label rate for the soil texture and organic matter.

Cadet™ Herbicide is a new product for FMC, however the active ingredient fluthiacet-methyl was developed by KI America and Novartis (now Syngenta) in the mid-1990s as Action® but was never commercialized. Cadet™ Herbicide is registered for corn (including field corn, sweet corn, and popcorn) and soybeans as a tankmix partner for glyphosate for improved control of broadleaf weeds. Cadet™ Herbicide is particularly strong on velvetleaf but also has activity on common waterhemp and common lambsquarters. Use 0.4 to 0.9 fluid ounces per acre; the 0.4 ounces per acre rate is recommended for a combination with glyphosate. Applications must be made after emergence of the crop and weeds. In soybean, apply Cadet™ Herbicide from the first trifoliate until full flowering stage. In corn, apply Cadet™ Herbicide from the two leaf stage (two visible leaf collars) until the corn is 48 inches tall or prior to tasseling, whichever comes first.

Rage™ D-Tech Herbicide is a combination of carfentrazone-ethyl and the ethylhexyl ester of 2,4-D and is registered as a burndown treatment in corn and soybean. Depending on the application rate, there is seven to 14 days planting interval in soybeans. In corn, again depending on the application rate, there is a three to 14 days planting interval. Rage™ D-Tech Herbicide can also be applied in corn from spike to the five leaf stage (eight inches tall) as a broadcast application at eight fluid ounces per acre or with drop nozzles at 12 fluid ounces per acre to corn up to 14 leaf collars or 36 inches tall. Weeds should be four to six inches in height.

**Gowan**

Gowan has a number of new products in their extensive generic herbicides portfolio. Those products that are of particular interest to Iowa include Imperium® (EPTC plus acetochlor), Permit® (halosulfuron-methyl), Targa® (quizalofop-P-Ethyl), Yukon® (halosulfuron-methyl and dicamba), TNT Broadleaf™ Herbicide (thifensulfuron-methyl and tribenuron-methyl) and Unity™ WDG Herbicide (thifensulfuron-methyl). Imperium® is now registered for use on sweet corn. TNT Broadleaf™ Herbicide and Unity™ WDG Herbicide are equivalent to Harmony® Extra and Harmony® GT herbicides, respectively. TNT Broadleaf™ Herbicide is registered as a burndown treatment in corn and soybeans and application should be at least 14 days prior to planting. Unity™ WDG Herbicide can be used as a preplant burndown treatment and should be applied before crop emergence.
Loveland Products, Inc.

Loveland has introduced Makaze™ Herbicide (isopropylamine salt of glyphosate) with Leci-Tech™ proprietary technology. Makaze™ Herbicide is formulated to provide superior droplet penetration, spreading, uptake and penetration according to the Loveland literature. Makaze™ Herbicide is labeled for use in Roundup Ready® corn and soybeans and has been evaluated by numerous land grant universities.

MANA

MANA (Makhteshim Agan of North America, Inc.) has a number of generic herbicides available including Arrow® 2EC (clethodim), Glyphogan® (glyphosate), Parallel®, Parallel PCS®, and Parallel Plus®, (metolachlor) and Parazone® 3 SL (paraquat).

Monsanto

Harness® and Degree® are no longer listed as restricted use herbicides and have new uses and additional rotational crops included on the label. Sweet corn will be added to these labels and rotational crops for the following growing season will include sugar beets, sunflowers, alfalfa, clover and others. It is anticipated that Harness Xtra® and Harness Xtra® 5.6L will be labeled for sweet corn in 2009, as well as have changes in rotational crops allowed. Monsanto continues to expand their efforts for stewardship of glyphosate and Roundup Ready® crops by adding additional alternative herbicides to the suggested uses described in the Technical Use Guide.

Syngenta

Syngenta has a number of label revisions to consider. Princep Caliber 90 and Princep 4L are prohibited for aerial application and have revised drift management language. Prefix™ (prepackage mixture of s-metolachlor plus fomesafen) is registered for postemergence application in soybeans and can be applied at cracking through the third trifoliate. Injury to the soybean is likely but symptoms are temporary. Prefix™ application should be made at least 90 days prior to harvest. Prefix™ should not be applied postemergence to soybeans that have been treated with an s-metolachlor product.

The Reflex® label has a number of changes. New wording about application timing, soybean injury, environmental conditions and weed resistance is included. Changes also exist in the section describing spray additives and replant options. Preplant surface and preemergence applications of Reflex® are included in the label and new tank mixture combinations are described. The Flexstar® label describes a tankmixture with glyphosate of up to 1.5 pint per acre to control glyphosate resistant weeds in Roundup Ready soybeans.

Dual Magnum® is now registered for pumpkins, rhubarb and horseradish. Language describing the postemergence application of Dual Magnum® is included and states clearly that while this herbicide can be applied postemergence to crops (corn, soybeans, and others), but will not control emerged weeds unless a herbicide with postemergence activity to weeds is included. Corn can be treated with Dual Magnum® after emergence until 40 inches tall while soybeans can be treated from emergence through the third trifoliate.

The Camix® label has added a use precaution that indicates other solo HPPD inhibitor postemergence
herbicides (Callisto®, Impact® or Laudis®) should not be applied to ground previously treated with Camix® in the same season. Similar statements are included in the Lexar® and Lumax® labels. Camix®, Lexar®, and Lumax® labels have revised weed resistance management language and caution about repeat applications of HPPD inhibitor herbicides during the same growing season. These sections also advise that two or more herbicide modes of action should be included as a good weed resistance management strategy. These herbicide labels also include revisions in the rotational crops section.

Callisto® is now registered for tankmixtures with Liberty® (glufosinate), Stout® (nicosulfuron plus thifensulfuron) and glyphosate postemergence in glyphosate resistant corn. Burcucumber is now included on the list of weeds “controlled” by Callisto®. The statement describing the aerial application restrictions with Callisto® has been revised (but does not allow aerial application) and a number of new crops have been added to the Callisto® label.

**United Phosphorus Inc.**

UPI has a number of generic herbicides that are available for use in Iowa corn and soybean production. These include Samson™ 4SC Herbicide (nicosulfuron), Metri™ Herbicides (metribuzin), Clopyr® AG Herbicide (clopyralid), Storm® Herbicide (bentazon and acifluorfen), and Ultra Blazer® Herbicide (acifluorfen).

**Valent**

Valent has registered Valor® SX for application on minimum and no tillage corn. Application of 1.0 to 2.0 ounces per acres must be made 14 to 30 days prior to planting. Valor® SX can also be applied in the fall but no earlier than October 15 or when soil temperature falls below 50°F at the two inch depth. This treatment will help control a number of winter and early spring annual weeds.

**Conclusions**

It is apparent that many companies continue to develop new and useful herbicides that offer important strengths for weed control in corn and soybean. It is also apparent that while these herbicides can be designated as “new” by a number of criteria, there has not been any new herbicides with new mechanisms of action. Importantly, the new products tend to have very specific usages and strengths and thus do not represent the newest “silver bullet” opportunity. Given the rapidly changing weed problems in Iowa, the best opportunity for growers is to apply appropriate Integrated Weed Management (IWM) and consider that unless a conscious and consistent stewardship effort is made, the ability to manage weeds will erode and profitability will quickly decline. While using IWM is not simple (and possibly convenient), neither is trying to develop a “quick fix” to resolve weed control problems after the fact. Recognize that when weed control problems evolve, they always cost more money than the appropriate well-thought tactic that should have been used in advance of the problem. Finally, when weed problems evolve, they will remain problems for a long time – develop IWM stewardship strategies and apply them before the weed problems occur.