What's Cropping Up?

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Mesotrione - A New Herbicide and Mode of Action

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Mesotrione is the active ingredient in Callisto herbicide. Callisto was registered in NY State in June 2002 for annual broadleaf weed control in field corn including corn grown for silage. The development of this new herbicide began in 1977 when a Zeneca biologist observed very few plants growing under his bottle brush (*Callistemon citrinus*) plants. Analysis of soil samples from beneath the plants revealed an allelopathic compound from the bottle brush plants identified as leptospermone. Laboratory work led to the discovery and synthesis of callistemons and mesotrione.

New Mode of Action

Mesotrione is a member of a new herbicide family/class called triketones and provides NY corn growers with a new mode of action that is effective against species resistant to triazine and ALS inhibiting herbicides. In general terms, mesotrione acts as a pigment inhibitor. While many are familiar with Command (clomazone), a pigment inhibiting herbicide used in pumpkins and soybeans, it should be noted that Command is in a different herbicide family than Callisto and inhibits pigments in a different way. Callisto inhibits an enzyme which in turn inhibits carotenoid biosynthesis. Carotenoid pigments protect chlorophyll from decomposition by sunlight. Injured weeds will appear white to translucent rather than chlorotic (yellow). Another herbicide, Balance (isoxaflutole), inhibits the same enzyme but is in a different herbicide family (isoxazole). Balance herbicide has never been registered in NY State.

Callisto is a systemic preemergence (PRE) and postemergence (POST) herbicide for the selective contact and residual control of broadleaf weeds in field corn. As a PRE herbicide, Callisto is absorbed by weeds during emergence and needs at least 0.25 inch of rainfall for activation. When applied POST, Callisto is absorbed through the treated foliage. It has activity on most of our important annual broadleaf weeds including velvetleaf, redroot/smooth pigweed, common ragweed, common lambsquarters, and wild mustard. It is not effective for control of most grass weeds. The one exception is large crabgrass. The Callisto label claims "partial control of large crabgrass with PRE applications and "control" when applied POST before large crabgrass exceeds 2 inches in height.

Callisto is formulated as a 4 lb/gal. soluble concentrate (SC). The PRE use rate for most soils is 6 fl oz/A while the POST rate is 3 fl oz/A. When applied POST, Callisto must be applied with 1% (v/v) of crop oil concentrate (COC) and 2.5% (v/v) of 28% UAN or AMS at 8.5 lb/100 gal. spray solution. For best results, POST applications should be made before weeds are 5 inches tall. Exceptions to this are noted on the label for large crabgrass and certain other weeds.

Velvetleaf Control

Field experiments with Callisto have been conducted at several locations across NY State since 1999. PRE applications of 6 oz/A of Callisto in combination with Dual II Magnum have provided velvetleaf control similar to that obtained with the PRE standard of Bicep Lite II Magnum plus Prowl. Sequential POST applications of 3 oz/A of Callisto following PRE applications of Dual II Magnum have also provided excellent control of velvetleaf. Of particular interest was a velvetleaf experiment in Livingston County in 2001. Corn was planted on May 24 and PRE treatments applied that same day. Rainfall for activating PRE herbicides was limited with only 1.01 inches recorded during the 4 weeks after application. The largest rainfall event was 0.35 inches recorded on May 29. Velvetleaf control with the PRE application of 2.1 qt/A of Bicep II Magnum alone and in combination with 3.6 pt/A of Prowl was 40 and 63% respectively (Table 1). The poor control with the standard Bicep II Magnum plus Prowl treatment was not a surprise since Prowl requires good rainfall for activation. The PRE application of 1.66 pt/A of Dual II Magnum plus 6 oz/A of

Weed Management

Herbicides	Amt/ Acre	When Appl.	Control (%) Velvet	Control (%) Pigweed	Yield (BuA)
Bicep II Magnum	2.1 qt	PRE	40	97	183
Bicep II Magnum + Prowl	2.1 qt 3.6 pt	PRE PRE	63	100	185
Dual II Magnum + Callisto	1.66 pt 6.0 oz	PRE PRE	91	91	185
Untreated	-	-	0	0	153
LSD (0.05)			13	10	18

Table 1. Velvetleaf and redroot pigweed control ratings and grain corn yields comparing PRE Callisto application with standard treatments in Livingston County in 2001.

Callisto provided 91% velvetleaf control. The improved control with Callisto compared with Prowl can probably be explained by the difference in water solubility of these two herbicides. The water solubility of Prowl is less than 1 part per million (ppm) while Callisto has a solubility of 15,000 ppm.

TR Lambsquarters

Triazine-resistant common lambsquarters control was investigated in Tompkins and Cayuga Counties in 2001 and 2002 respectively. Lambsquarters control ratings and grain corn yields are shown in Table 2. PRE application of 1.5 qt/A of Bicep Lite II Magnum controlled only 57 and 23% of the lambsquarters in 2001 and 2002 respectively while the combination of Bicep Lite II Magnum plus Prowl controlled 99 and 100% of the lambsquarters. PRE applications of Dual II Magnum plus 6 oz/A of Callisto provided 98 and 99% lambsquarters control while the sequential early postemergence (EPO) application of 3 oz/A of Callisto following a PRE application of Dual II Magnum controlled 98 and 100% of the lambsquarters respectively in 2001 and 2002. Grain corn yields responded nicely to the level of weed control in both years. In 2001, the untreated check produced 66 Bu/A and the Bicep Lite II Magnum treatment, which provided 57% control, produced a yield of 137 Bu/A. Lambsquarters control with the Prowl and Callisto treatments averaged 98% and had an average yield of 157 Bu/A. Results in 2002 showed lambsquarters control at 23% with Bicep Lite II Magnum while treatments that included Prowl or Callisto averaged 99% control. The untreated check and Bicep Lite II Magnum treatments had grain corn yields of 45 and 78 Bu/A respectively. The treatments that included Prowl or Callisto had an average yield of 128 Bu/A.

Table 2. Triazine-resistant common lambsquarters control ratings and grain corn yields comparing PRE and EPO Callisto applications with standard treatments in Tompkins and Cayuga Counties in 2001 and 2002 respectively.

Herbicides	Amt/ Acre	When Appl.	Control (%) 2001	Control (%) 2002	Yield (Bu/A) 2001	Yield (Bu/A) 2002
Bicep Lite II Mag + Prowl + Python	1.5 qt X pt 1.0 oz	PRE PRE PRE	57 99 99	23 100 95	137 153 156	78 130 132
Dual II Magnum + Callisto	1.33 pt 6.0 oz	PRE PRE	98	99	158	126
Dual II Magnum + Callisto*	1.33 pt 3.0 oz	PRE EPO	98	100	159	127
Untreated	-	-	0	0	66	45
LSD (0.05)			7	8	19	20

* Applied with 1% (v/v) COC and 2.5% (v/v) 28% UAN.

Common Ragweed Control

Common ragweed control with Callisto has not been as consistent as control of some other annual broadleaf weeds. In an effort to better determine the efficacy of Callisto against ragweed, experiments were established at Aurora and Valatie in fields with heavy ragweed pressure in 2002. At Aurora, the PRE combination of Dual II Magnum plus 6 oz/A of Callisto provided 86% late season ragweed control compared with 91% control with a PRE application of 1.5 qt/A of Bicep Lite II Magnum (Table 3). The sequential mid-postemergence (MPO) application of 3 oz/A of Callisto following a PRE application of Dual II Magnum controlled 80% of the ragweed. At Valatie, in the Hudson Valley, the PRE application of Dual II Magnum plus 6 oz/A of Callisto and the PRE standard of 1.1 qt/A of Bicep Lite II Magnum controlled 65 and 55% of the ragweed respectively. Late season ragweed control with a sequential application of 3 oz/A of Callisto was 97%. The Callisto label includes PRE tank mixes with atrazine premixes and POST tank mixes with 0.5 to 1 pt/A of AAtrex 4L (up to 12 inch corn). These tank mixes should provide added activity against ragweed unless the ragweed is triazine-resistant. When ragweed control ratings were averaged over 3 site years, PRE application of 6 oz/A of Callisto provided 83% control (data not shown). When averaged over 5 site years, MPO applications of 3 oz/A of Callisto alone and when tank mixed with 0.5 pt/A of AAtrex provided 92 and 100% ragweed control respectively.

Mesotrione Premixes

Although not yet registered for use in NY State, new mesotrione premix products Lumax and Camix were included in 2002 field experiments. Lumax is a three-way premix of *S*-metolachlor (Dual II Magnum), atrazine, and mesotrione while Camix is a two-way premix of *S*-metolachlor and mesotrione. PRE applications of 2.5 and 3 qt/A of Lumax and of 2 and 2.4 qt/A of Camix provided excellent control of velvetleaf, common lambsquarters, and wild mustard. The PRE application of Camix (*S*-metolachlor plus mesotrione) controlled 85% of the common ragweed while the three-way premix of Lumax controlled 93% of the ragweed. PRE applications of Bicep Lite II Magnum and Bullet controlled 87% and 90% of the common ragweed, respectively.

Rotational Restrictions

Both Callisto and Lumax, which is likely to be registered for the 2003 growing season, have significant rotational restrictions. For Callisto, the restrictions include the following: 1) small grains may be planted 120 days after application, 2) soybeans, sorghum, potatoes and sweet corn can be planted the following year, and 3) peas, dry beans, snap beans, red clover, alfalfa, and other rotational crops may be planted 18 months after Callisto application. Should Lumax receive registration prior to the 2003 growing season, corn growers would not be able to rotate to crops other than corn (all types), soybeans, or sorghum the spring following Lumax application.

Although having a new herbicide mode of action to use in herbicide-resistance management programs is exciting, growers should consider cost effectiveness and rotational restrictions when deciding how these new herbicide products might fit into their weed management programs.

Table 3. Common ragweed control ratings and grain corn yields comparing PRE and MPO Callisto applications with standard treatments at Aurora and Valatie in 2002.

Herbicides	Amt/ Acre	When Appl.	Control (%) Aurora	Control (%) Valatie	Yield (Bu/A) Aurora	Yield (Bu/A) Valatie
Bicep Lite II Mag	X qt	PRE	91	55	84	56
Dual II Magnum + Callisto	X pt 6 oz	PRE PRE	86	65	92	50
Frontier + Marksman	X oz X pt	PRE MPO	100	95	94	73
Dual II Magnum + Callisto*	X pt 3 oz	PRE MPO	80	97	82	88
Untreated	-	-	0	0	9	5
LSD (0.05)			7	9	20	16

* Applied with 1% (v/v) COC and 2.5% (v/v) 28% UAN.

Crop Management

Hybrid Selection and Site-Specific Planting in Corn

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Selecting the highest performing hybrid for a farm can greatly affect the bottom line. Also, corn yields often show significant spatial variability, which may provide an opportunity to select hybrids according to the yield potential for distinct regions within a field. Very few studies have evaluated this potential. We conducted field-scale research in 1999, 2000 and 2001 at two sites on a dairy farm in Onondaga county and three sites on two cash crop farms, in Seneca county to refine the process of hybrid selection. Our objectives were i) to determine the usefulness of yield monitors in identifying field specific hybrid response and ii) to determine if it is advantageous to use site-specific hybrid planting within fields. The fields ranged in size from 14 acres to 24 acres. We chose Pioneer 3752 and 37M81, because these two hybrids had shown yield differences between sites. We used a split-planter approach where alternating strips of each hybrid were planted, and yields were measured using combines with yield monitors and differential GPS. Detailed information on the management of the field trials were reported previously (Vol.12, No.5, p. 1-5).

Corn yield showed spatial variability at 12 of 15 site-year comparisons with significant spatial variability at all sites in 1999 and 2001, the dry years (Vol.12, No.5, p.1-5). Corn also yielded differently at the Onondaga versus the Seneca sites in 1999 and 2001 with 37M81 averaging 15 bu/acre more than 3752 at the Onondaga 1 site, and 12 bu/acre more at the Onondaga 2 site (table 1). Weather conditions and management practices were mostly the same across sites, so different soil types and fertility levels from manure application presumably contributed to corn yielding differently at the Onondaga versus the Seneca sites. Corn yield, however, showed site specific hybrid response in only four of 15 site-year comparisons, which indicates that the hybrids had similar relative yield differences throughout most fields. Corn thus yielded differently at the Onondaga compared to the Seneca sites, presumably because of different soil conditions across sites, but few showed site specific hybrid response, despite spatial variability for corn yield at most sites.

Corn yield showed site specific hybrid response at the Onondaga 1 site in 1999 and 2001, which suggests that variable hybrid selection would be attractive within this field. Also, the spatial relationship of corn yields had high temporal stability (r = 0.88) in dry years, with yields above 145 bu/acre in western and northeastern regions and yields below 95 bu/acre in southeastern regions in 1999 and 2000 (Fig.1). In 1999, 3752 compared with 37M81 yielded the same or greater in the northeastern region, while 37M81 yielded greater or the same in the central portion of the field (Fig.1). In 2001, 37M81 compared with 3752 yielded greater in the southern central region of the field and the same in the remaining areas of the field. Although corn showed site-specific hybrid response at the Onondaga 1 site in the dry years, variable hybrid selection would not be the appropriate management practice because 37M81 vs. 3752 yielded the same or greater in most areas of the field.

Conclusion

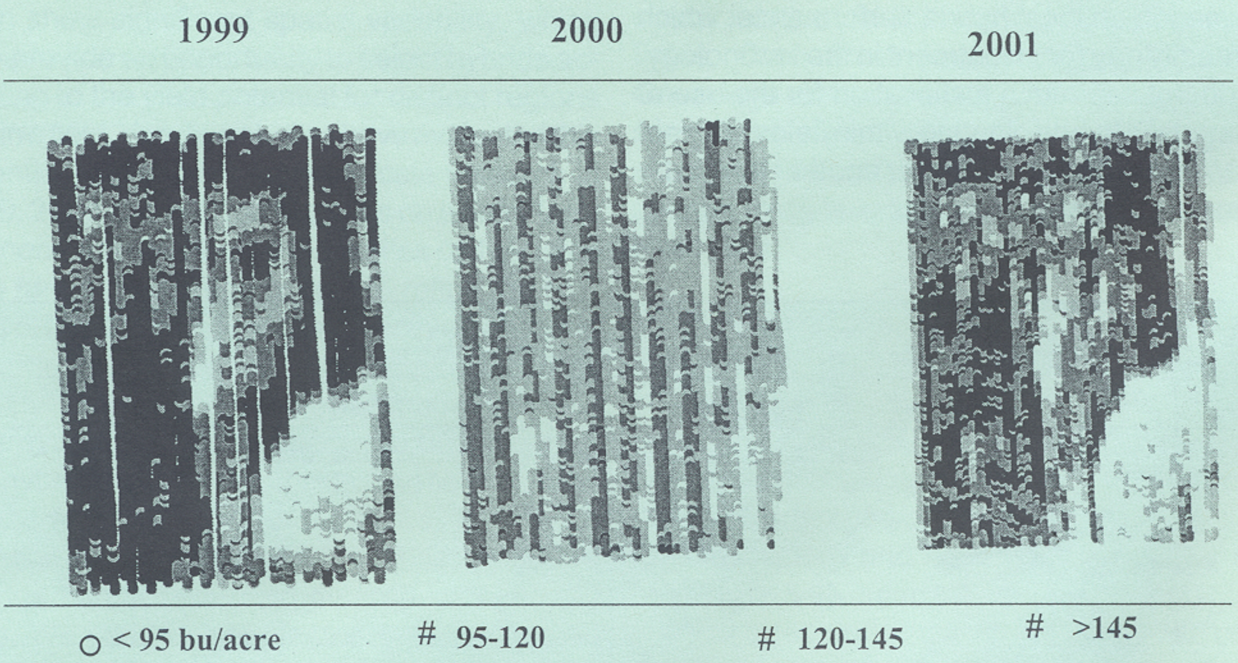
Hybrids responded differently for the Onondaga (manured) vs. Seneca (non-manured) fields. The average yield advantage was in some cases quite high, ranging from 6 to 21 bu/acre, in the case of 37M81 out-yielding 3752, and would greatly affect the bottom line. Yield monitors and split-planter trials therefore provide very valuable information on local hybrid performance, which will readily pay for investment in the technology. We do not see much justification for the use of site-specific hybrid planting within fields, as yield advantages of one hybrid over another tend to be inconsistent in a field.

Table 1. Corn grain yield of two hybrids at five sites during the 1999, 2000, and 2001 growing seasons.

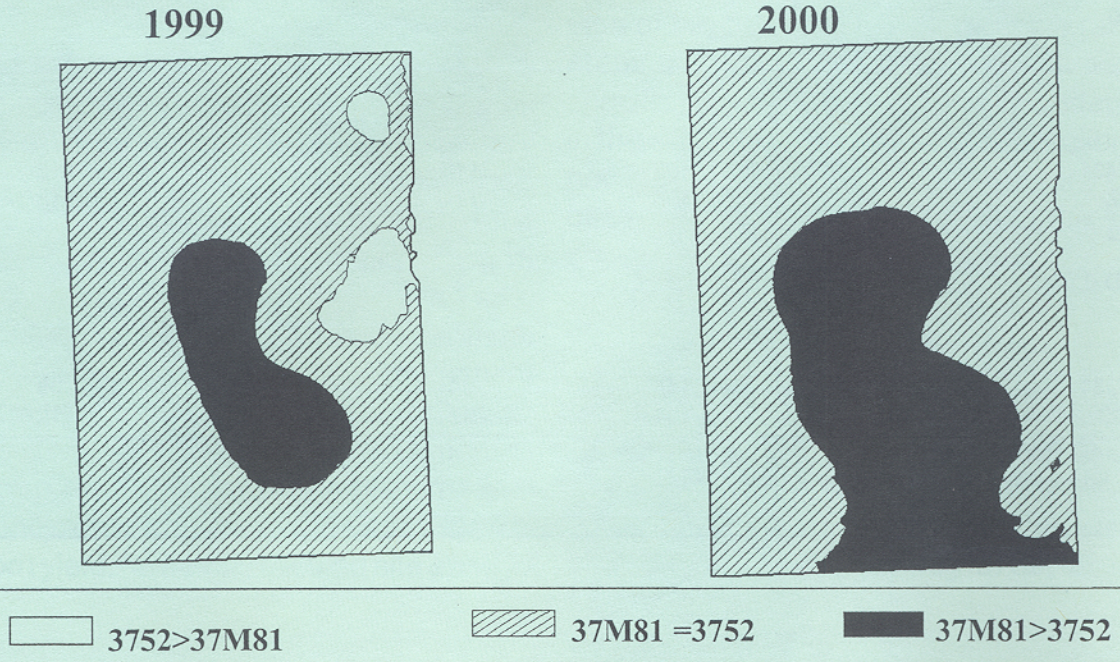
	Onondaga1	Onondaga 2	Seneca 1	Seneca 2	Seneca 3
		--------bu/acre--------			
			1999		
37M81	145	154	59	94	102
3752	138	145	56	102	107
Avg					
LSD 0.05†	3 †	8	NS	4	4
			2000		
37M81	118	122	105	126	114
3752	102	102	97	118	111
Avg					
LSD 0.05	3	4	4	3	NS
			2001		
37M81	134	162	118	135	113
3752	113	156	124	138	118
Avg					
LSD 0.05	6	3	3	NS	4
			Average		
37M81	**132**	**146**	**94**	**118**	**109**
3752	**117**	**134**	**92**	**119**	**112**

†Comparison of means between hybrids.
NS, nonsignificant at the 0.05 probability level.

Fig. 1. Corn yields in 1999, 2000 and 2001 at the Onondaga 1 site.



Corn yield differences, based on LSD (0.05) interaction values in 1999 and 2001 between field locations and hybrids at Onondaga 1(a = 15bu/acre, b= 20 bu/acre)



Crop Management

Recommended Roundup Ready Soybean Varieties for Central and Western New York

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We evaluated Group I and Group II Roundup Ready soybean varieties at the Aurora Research Farm in Cayuga Co. and in western New York (Livingston Co. in 2002). In 2002, the Aurora Research Farm had its driest July on record (0.81") and second driest August (1.52"). From June 26th through September 15th, the Aurora Research Farm received about 2.5" of precipitation, which resulted in very low yields at that site. In contrast, our western NY site received some timely rains in July and August, which resulted in average yields at that site.

The Group I Roundup Ready varieties, X199 (Agway) and S1918-4 (Stine) did exceptionally well in 2002 (Table 1). Both varieties yielded the greatest at the very dry Aurora site and the western NY site, which indicates that these varieties have excellent yield stability. Other promising Group I varieties include AG1902 (Asgrow), T9936 (Hyland), X198 and X213 (Agway), and T0152 (Hyland).

The Group II Roundup Ready variety S24-K4 (Northrup King) has yielded exceptionally well in New York since 2000. In 2002, S24-K4 yielded as high or higher when compared with other varieties in the test (Table 1). Other varieties that yielded well include AG2705 and AG2105 (Asgrow), DKB25-51 and DKB31-52 (DeKalb), X200, X214, and X218 (Agway), and S23-Q3 (Northrup King), and S2736-4, and S2736-04 (Stine). In the Group II test, however, some varieties did not hold up as well in the drought-stressed environment.

Variety selection is one of the most important management practices that soybean growers make. Soybean growers should closely examine all information sources before selecting their varieties.

Table 1. Yields of recommended Roundup Ready soybean varieties (Group I and Group II) at Aurora and western New York in 2002.

VARIETY	AURORA	WESTERN NY
	bu/acre	
Group I		
X199	32	63
S1918-4	35	62
AG1902	29	56
T9936	31	53
X198	27	54
X213	32	49
T0152	25	55
Group II		
AG2705	33	60
DKB25-51	31	61
DKB31-52	27	63
S24-K4	32	56
AG2105	29	58
X200	33	54
X214	32	54
S2736-4	31	54
S23-Q3	28	57
X218	24	59

Pest Management

Corn Rootworm: What is on tap for 2003

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Dry soil conditions during the period of larval rootworm development in June and July enhanced the survival of rootworm larvae resulting in one of the largest adult rootworm populations observed in the past 15 years. In addition, root damage was very obvious in many fields due to both the higher than normal larval pressure and the dry soil conditions which inhibited root regrowth and corn's recovery to rootworm feeding. The effects of the drought was magnified by the presence of rootworm feeding injury on the roots. The rootworm damage in many fields went unnoticed by many producers particularly if the field did not lodge and the producers of these fields lamented about the extreme severity of the drought on their corn production. In similar fields where rootworm was controlled with rotation or insecticide, better than expected yields were often realized in spite of the severity of the drought.

High adult numbers in the late summer of 2002 coupled with the expected large number of eggs laid in existing corn fields may or may not be a predictor of rootworm pressure in 2003. Ultimately, rootworm pressure in 2003 is dependent on the winter survival of the over wintering eggs in the soil and the water saturation conditions of the soil during the larval hatching period in late May- early June. Field capacity soils during the hatching period cause a large numbers of larvae to die from drowning. With a long stretch of potentially adverse environmental conditions ahead, predictions on insect severity is difficult.

Management Options for 2003:

With all of the new technology for rootworm on the horizon, it is easy to forget the effectiveness of crop rotation on the control of corn rootworm. Fields which are in their 4th and later year of continuous corn would benefit from rotation to non-host crops. Rootworm pressure tends to build with each continuous year of corn and populations peak during the 4-5 year. Crop rotation saves the cost of the insecticide because fields rotated into corn from other crop do not need corn rootworm control measures.

If crop rotation is not an option and adult beetle counts for each field are not available, then the only options open to producers is to either take your chances with economic losses from rootworm damage or use an insecticide to mitigate or minimize the damage from rootworm even though there is a probability that economic losses may not occur in that field. If the producer decides to use a granular soil insecticide at planting, excellent results can be expected with the use of either Force™ Counter™or Lorsban™(soil ph < 7.5) insecticide. Materials should be applied in a T-Band in front of the press wheel for best performance. If the producer decides to use liquid soil insecticides, consistent results for the past 3 years have been recorded in Cornell University research plots with Regent™insecticide. While Capture™insecticide gave good control results in 2002, this insecticide was variable in control in 2001. As in the case with granular insecticides, liquid insecticides need to be applied in a T-Band for the best performance.

While seed applied rootworm insecticides are an exciting technological advance, the materials on the market (Force ST & Prescribe) continue to give variable performance. Field tests of a new Bayer product in the final stages of registration show much more consistent results with rootworm control. The new product is called Clothianidin and will be marketed by Gustafson for application as a seed coating. Registration of this material is projected to be completed by Spring of 2003 which will allow sizeable demonstration field trials.

Monsanto continues to push for EPA registration of their BT-rootworm resistant corn. This product continues to look great in field plots within NY and across the corn belt. Monsanto has applied for a conditional registration of their product which would allow them to begin planting large demonstration trials, begin selling the seed to producers in limited quantities and larger trial would allow researchers to begin addressing some of the larger concerns about rootworm developing resistance to the BT-gene. Monsanto is optimistic that EPA will grant them a conditional registration by the spring of 2003. Pioneer also has a rootworm-resistant corn in the development pipeline but their product appears to be at least 2 years behind Monsanto.

Rectification:

In the article entitled "Nitrogen Management for Sorghum Sudangrass. How to optimize N uptake efficiency?" by Kilcer, T., Q.M. Ketterings, T. Katsvairo and J.C. Cherney that appeared in the last issue of What's Cropping Up? (Volume 12, Issue 5, Pages 6-9), erroneous values were reported for predicted milk yield in lbs/acre. The conclusions of the study are not affected by this error. The corrected table is listed below.

Table 1: N, P and K removal, N fertilizer uptake efficiency and predicted milk yield (milk/ton and milk/acre) of brown mid rib sorghum sudangrass in response to N application rate and method (at planting/after the first cut) at the Valatie Research Farm, Columbia County, NY (2000 data).

N application		Nutrient Removal			N Uptake Efficiency		Predicted Milk Yield	
Total	Method	N	P_2O_5	K_2O	1st cut	Total		
------ lbs/acre ------		-------------- lbs/acre --------------			--------- % ----------		lbs/ton	lbs/acre
0	0/0	50 d	35 c	117 c	-	-	3010 a	5981 d
100	100/0	86 c	46 b	155 bc	29 a	36 ab	3057 a	9772 c
150	150/0	83 c	46 b	172 ab	15 a	22 b	2989 a	9650 c
150	75/75	113 b	61 a	196 ab	17 a	42 a	3000 a	13428 ab
200	200/0	115 b	50 b	177 ab	26 a	32 ab	3000 a	10874 bc
200	100/100	146 a	70 a	227 a	22 a	48 a	2932 a	15590 a

Note 1: Milk yield predictions according to Milk 2000 (http://www.uwex.edu/ces/forage/pubs/milk2000.xls).

Note 2: See text for definition of N uptake efficiency.

Note 3: Average values *within columns* with different letters (a,b,c) are statistically different ($\alpha = 0.05$).

Calendar of Events

January 6-9	Northeastern Weed Science Society Annual Meeting, Baltimore, MD
January 7-8	Northeast Grower Agri-business Conference and NYSABA Annual Meeting, Holiday Inn, Electronics Parkway, Syracuse
January 21	Western NY Corn Congress, Holiday Inn, Batavia
January 22	Finger Lakes Corn Congress, Holiday Inn, Waterloo
January 22	Winter Crop Meeting, Clarion Inn, Ithaca
February 5	Western NY Soybean & Small Grain Congress, Batavia
February 6	Finger Lakes Soybean & Small Grain Congress, Waterloo
February 10-13	Weed Science Society of America Annual Meeting, Jacksonville, FL
February 13	Crop Production 2003 Meeting, Auburn
February 19	North Country Corn Congress, Miner Institute, Chazy

What's Cropping Up? is a bimonthly newsletter distributed by the Crop and Soil Sciences Department at Cornell University. The purpose of the newsletter is to provide timely information on field crop production and environmental issues as it relates to New York agriculture. Articles are regularly contributed by the following Departments at Cornell University: Crop and Soil Sciences, Plant Breeding, Plant Pathology, and Entomology. **To get on the mailing list, send your name and address to Pam Kline, 234 Emerson Hall, Cornell University, Ithaca, NY 14853.**

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