The Effect of Renew (RN98, RN99), Renew Plus (RP96, RP97) and Reclaim (RC-98) on Crop Yields in Replicated Studies

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Renew Plus (RP-) is an AgPro Systems proprietary formulation of trace minerals, humic acid, surfactants, and fermentation products. Applied to the soil with broadcast banded, or in-furrow methods, it has demonstrated enhanced yields in a variety of crops and turf.

Reclaim (RC-98) is a formulation of fermentation-derived enzymatic compounds and surfactants designed to enhance pesticide residue decomposition, ameliorate sodium problems, and improve soil physical properties. Studies on most effective rates and application methods for a particular soil type are continuing. Generally, soils with appreciable clay content require higher applications for optimum response.

Efficacy studies with these and other AgPro Systems products are summarized and reported annually and are intended for growers, university and private research cooperators, and cooperative extension personnel.

Copies of complete reports and data sets may be requested by writing or calling AgPro Systems.

1996 STUDIES

The objective of these four field studies was to evaluate the effects of this product scientifically in replicated plots with two corn and two soybean hybrids grown on different soils using broadcast, banded and in-furrow application methods.

The studies were installed at the Center for International Research and Training in Agriculture (C.I.R.T.A.) at Parkersburg, Iowa.

Procedure

All studies utilized a randomized complete block design with six replications. Plots consisted of six rows 15 feet wide and 40 feet long. Appropriate herbicides were applied as in normal practice (Roundup and Accent on corn, Roundup and Post Plus plus Concert on soybean plots).

Broadcast and banded treatments were applied with a bicycle sprayer and in-furrow treatments were applied at planting.

Plots were planted using a six-row John Deere Max Emerge planter.

The middle two rows of each corn plot and the middle four rows of each soybean plot were harvested with a Gleaner K combine equipped with electronic harvesting hardware.

Grain yield, moisture content, test weight and plant population (corn only) were measured.

Analysis of variance was performed on the raw data. Means separation was determined using an LSD test performed at the 0.05 level of probability.

Results and Discussion

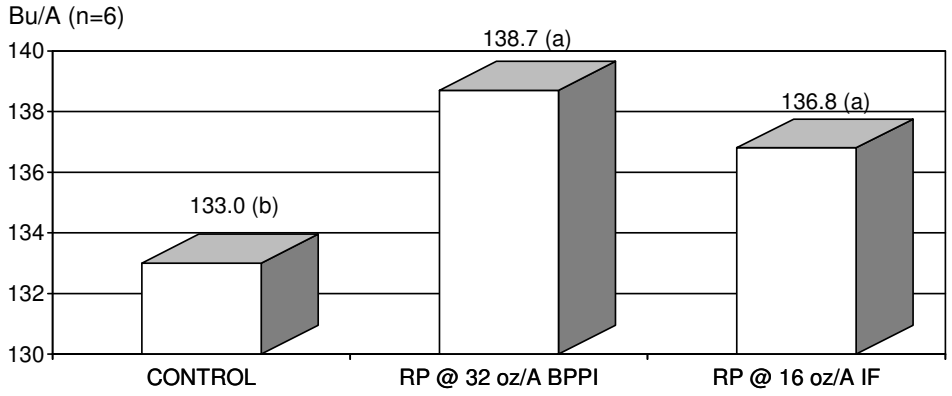
Field Corn 1

The first study utilized the Stine 061 hybrid and was planted on June 12, 1996 at 30,200 seeds per acre in a Bremer silt clay loam fertilized with 100 lbs. of nitrogen per acre.

Significant yield differences between treatments were detected at the 0.02 level of probability. Renew Plus in both broadcast and in-furrow treatments gave greater yields than the fertilized control (Figure 1).

Figure 1. YIELD ENHANCEMENT IN FIELD CORN WITH RENEW PLUS™

STINE 1061 HYBRID. NITROGEN APPLIED TO ALL TREATMNTS @ 100 lbs/A.
Center for International Research and Training in Agriculture. Parkersburg, Iowa. 1996.



Means followed by different letters are significantly different ($P \leq 0.02$)
BPPI=Broadcast Pre-Plant Incorporated IF=In-Furrow

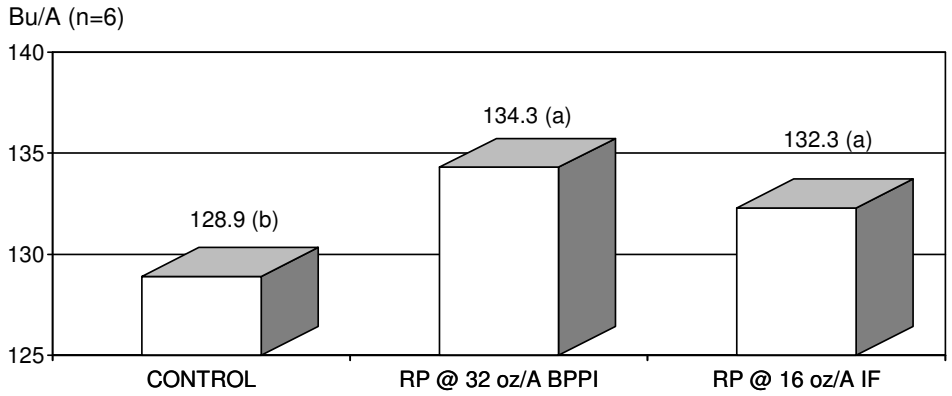
Field Corn 2

This study used the Ciba IMI 4306 hybrid. It was planted on June 24, 1996 at 30,200 seeds per acre in a Bremer silt clay loam fertilized with 100 lbs. of nitrogen per acre.

Treatment differences were significant the 0.006 level. Again both broadcast (32 oz. per acre) and banded (16 oz. per acre) applications of Renew Plus with 100 lbs. of nitrogen per acre out-yielded the control with 100 lbs. of nitrogen per acre without Renew Plus (Figure 2).

Figure 2. YIELD ENHANCEMENT IN FIELD CORN WITH RENEW PLUS™

CIBA IMI 4306 HYBRID. NITROGEN APPLIED TO ALL TREATMNTS @ 100 lbs/A.
Center for International Research and Training in Agriculture. Parkersburg, Iowa. 1996.



Means followed by different letters are significantly different ($P \leq 0.006$)
BPPI=Broadcast Pre-Plant Incorporated IF=In-Furrow

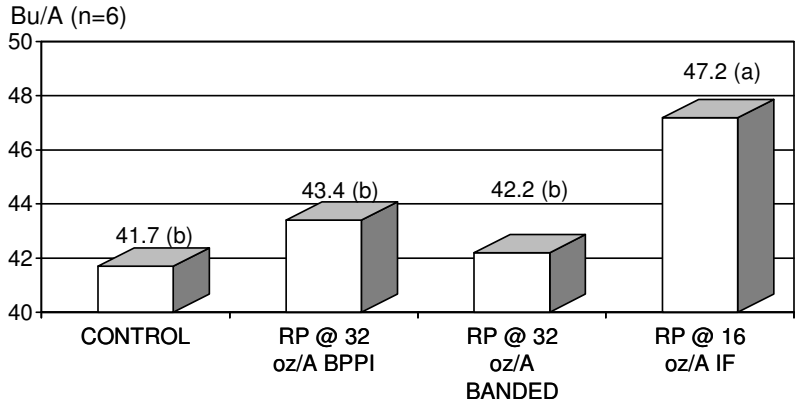
Soybeans 1

Kruger 2525 soybeans were planted in a Readlyn silt clay loam at 55 lbs. per acre on June 22. No fertility was used with any treatment or the control. Harvest was performed on October 19.

Yield differences were significant at the 0.02 level. Renew Plus applied in-furrow at 16 oz. per acre provided the highest grain yield (Figure 3).

Figure 3. YIELD ENHANCEMENTS IN SOYBEANS WITH RENEW PLUS™

KRUGER 2525 HYBRID.
Center for International Research and Training in Agriculture. Parkersburg, Iowa. 1996.



Means followed by different letters are significantly different ($P \leq 0.02$)
BPPI=Broadcast Pre-Plant Incorporated IF=In-Furrow

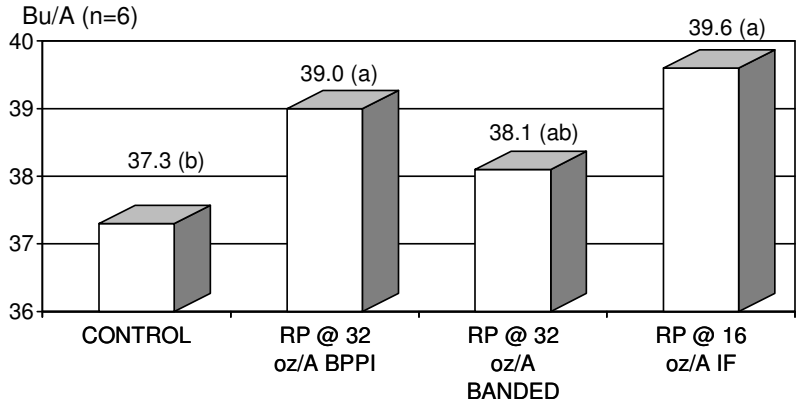
Soybeans 2

Stine 2250 soybeans were planted in a Bremer silt clay loam at 55 lbs. per acre. No fertility was used with any treatment or the control. Harvest was on October 19.

Yield differences were significant at the 0.03 level. Renew Plus applied in furrow at 16 oz. per acre and broadcast at 32 oz. per acre provided significant yield increases over the control (Figure 4).

Figure 4. YIELD ENHANCEMENTS IN SOYBEANS WITH RENEW PLUS™

STINE 2250 HYBRID.
Center for International Research and Training in Agriculture. Parkersburg, Iowa. 1996.



Means followed by different letters are significantly different ($P \leq 0.03$)
BPPI=Broadcast Pre-Plant Incorporated IF=In-Furrow

Summary and Conclusions

Application of Renew Plus on two corn hybrids grown on two different soil types produced statistically significant yield increases when applied broadcast at 32 oz. per acre or in-furrow at 16 oz. per acre.

Application of Renew Plus on two soybean hybrids grown on two different soil types produced statistically significant yield increases when applied in-furrow at 16 oz. per acre.

Coefficients of variation were 1.70% and 2.06% on corn grain yield and 3.25% and 6.53% on soybean grain yield.

Based on the results from these studies, Renew Plus should provide substantial economic benefit when included in a corn or soybean production program.

1997 STUDIES

In 1997 the emphasis was on verifying the 1996 results on corn and soybeans and on expanding the research to include other crops.

Studies were again installed at C.I.R.T.A. at Parkersburg, Iowa with similar studies in sandier soils at the University of Wisconsin's Hancock Research Station at Hancock, WI.

Field Corn (C.I.R.T.A.)

The experimental design of this project was a randomized complete block with six replications. Each plot consisted of 6 rows, 35 feet long and 30 inches apart.

The field was disked on May 12, 1997 and May 15, 1997. Dual II (2 pt/ac) and Attrex 4L (3 pt/ac) were applied on May 13.

AV 759 corn was planted in a Lawler silt loam at 30,200 seeds/A on May 21, 1997 using a 6-row John Deere Max Emerge planter. Kickoff (3 lb/a) and 8-19-3 (5 gal/a) were applied in-furrow over all treatments. In addition, 28% UAN (45 lb N/a on the control, 25% less on treatments 2, 3, and 4) was sidedressed at planting 2 inches deep and 6 inches from the row.

Treatments consisted of an untreated control, Renew Plus applied broadcast, preplant at 32 oz/A, Renew Plus applied in-furrow at planting at 16 oz/A and Renew Plus applied in furrow at planting at 16 oz/A plus 16 oz applied broadcast (foliar) 22 days after planting on June 12.

On July 10, the final 28% UAN (45 lbs N/a on the control, 25% less on treatments 2, 3, and 4) was sidedressed in the same manner as the first application.

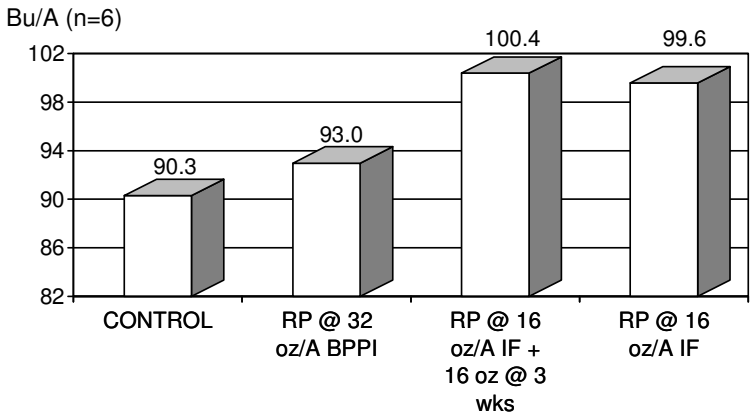
The center two rows of each plot were harvested October 18, 1997 using a Gleaner K combine. Plant population was recorded before harvest. Grain yield, test weight, and moisture content were recorded using an Almaco Seed Spector 1.

Although treatments of 16 oz/A applied in-furrow gave the highest yields (Figure 5), differences were not statistically significant. Differences in plant population, moisture content and test weight were likewise not significant.

This result in itself is interesting, since it indicates that nitrogen application can be reduced 25% where Renew Plus is applied with no significant effect on yield or the other parameters. Furthermore, this may be successful even under unfavorable conditions such as excess moisture and the cold spring conditions that prevailed in 1997.

Figure 5. YIELD ENHANCEMENTS IN FIELD CORN WITH RENEW PLUS™

AV 759 HYBRID. NITROGEN REDUCED 25% IN ALL RENEW PLUS TREATMENTS
Center for International Research and Training in Agriculture. Parkersburg, Iowa. 1997.



Note: The control received 90 lb/A of N as 28% UAN. Renew Plus treatments received only 68 lb/A of N as 28% UAN

Last season, application of Renew Plus at 32 oz per acre (broadcast) and at 16 oz/A (in-furrow) produced significant increases. However, 1997 started with a cold spring, which reduced emergence, and followed with wet conditions in late spring and early summer, which hampered crop development and weed control. The result was large plot variability and below-normal yields. The coefficient of variation for this study was 19.71% on corn grain yield.

Field Corn (U. of Wisconsin)

Dr. Edward Oplinger was the research cooperator in this study. The experimental design was a randomized complete block with four replications. Plots were 10' x 25' on a 30-inch row spacing.

Aatrex 4L (0.75 qt/A) and Lasso (2 qt/A) were applied preemerge. The plots were disked and planted on May 19, 1997 into a Plainfield sand.

DeKalb 471 was planted at 32,000 seeds/A using a John Deere 7000 planter. Kickoff fertilizer (3 lb/A) was applied in-furrow over all treatments and 100# of N as 300# of 33-0-0 as applied twice on June 23 and July 1.

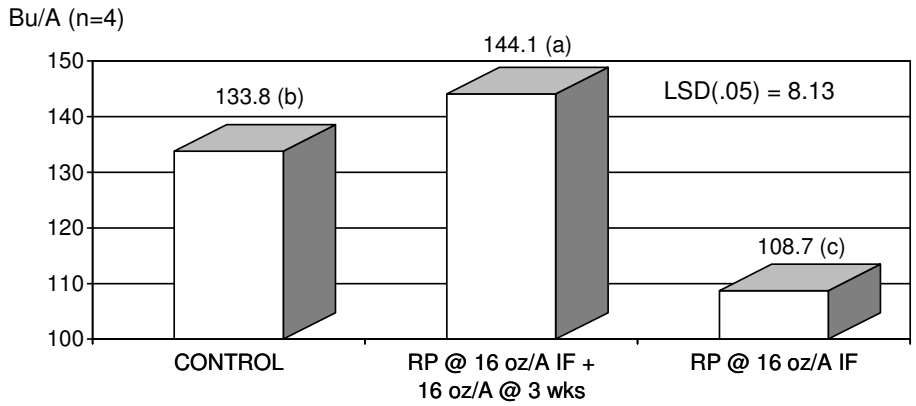
Treatments consisted of a control, Renew Plus at 16 oz applied in-furrow, and Renew Plus at 16 oz/A in-furrow + 16 oz/A broadcast @ 21 days after emergence. The central 5' x 20.5' of each plot was harvested on October 29, 1997 using an Almaco plot combine #2.

The 16 oz in-furrow rate + 16 oz. applied broadcast (foliar) gave a significant increase in yield (Figure 6). Dr. Oplinger indicated since there were no differences in test weight, the increase in yield resulted from more kernels per ear rather than larger kernels.

Figure 6. YIELD ENHANCEMENTS IN FIELD CORN WITH RENEW PLUS™

DEKALB 471 HYBRID

Dr. E. S. Oplinger. University of Wisconsin. Hancock Research Station. Hancock, Wisconsin. 1997.



Means followed by the same letter do not differ significantly (P < 0.01)

The wet season apparently had less of a deleterious effect further to the east in Wisconsin, especially in these well-drained sandy soils. It is not clear why 16 oz/A of Renew applied without the additional 16 oz/A broadcast post-emerge treatment caused a yield decline. It is speculated that the single application caused a temporary mineralization of soil nutrients which was quickly leached away with the excess soil moisture permeating these lighter soils. This resulted in less available fertility for plants receiving this treatment.

Soybeans (C.I.R.T.A.)

A randomized complete block design with six replications consisting of 6 rows 40 feet long on a 30 inch spacing was used in this study.

The field was disked on May 12 and on May 19, 1997. Stine 2254 RR soybeans were planted in a Marshan silty clay loam at 140,000 seeds/A on May 22 using a 6-row John Deere Max Emerge planter. Three treatments including one control were used in this study. A standard program of 1 gal/A 8-19-3 and 3 lb/A Kickoff was applied in-furrow across all treatments.

Treatments consisted of an untreated control, Renew Plus at 32 oz/A at planting, Renew Plus at 16 oz/A at planting plus 16 oz. applied after emergence.

The foliar treatment was applied 3 weeks after planting on June 12, 1997 with a JD 322 mounted sprayer.

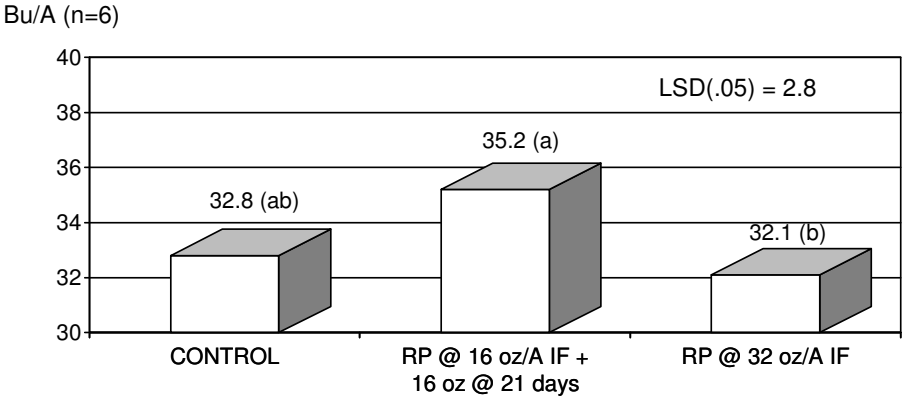
Roundup Ultra was applied at 48 oz/A on July 5. The plots were then cultivated on July 16. A final treatment of 16 oz/A of Roundup Ultra was applied August 21, 19997.

The center four rows of each plot were harvested October 6, 1997 using a Gleaner K combine. Grain yield, test weight, and moisture content were recorded using an Almaco Seed Spector 1.

There were no significant differences in test weight, moisture content or plant population. However, the 16 oz/A in-furrow + 16 oz applied post-emergent gave the highest yield (Figure 7).

Figure 7. YIELD ENHANCEMENT IN SOYBEANS WITH RENEW PLUS™

STINE 2254 RR SOYBEANS
Center for International Research and Training in Agriculture. Parkersburg, Iowa. 1997.



Even with this season's wet spring conditions which tended to reduce yields, these findings seem to confirm the efficacy of the 16 oz/A in-furrow rate on soybeans.

Soybeans (U. of Wisconsin)

Dr. Oplinger also cooperated in a study of Renew Plus which utilized a randomized complete block design with four replications.

Plot size was 10' x 25' with a 30" row spacing.

Lasso (2 qt/A) and Lorox (0.5 lb/A) were applied preemerge. Plots were disked and then planted on May 19. Midwest 2100 soybeans were planted in a Plainfield sand at 9 seeds per foot of row using a John Deere 7000 planter.

Kickoff starter (3 lb/A) and 100 lb/A of 0-0-60 (applied April 4) were applied to all plots.

Treatments consisted of a control, Renew Plus at 16 oz/A applied in furrow + 16 oz/A broadcast at 21 days after emergence, and Renew Plus at 32 oz/A in furrow.

The central 5' x 20.5' of each plot was harvested on October 8 using an Almaco plot combine #1.

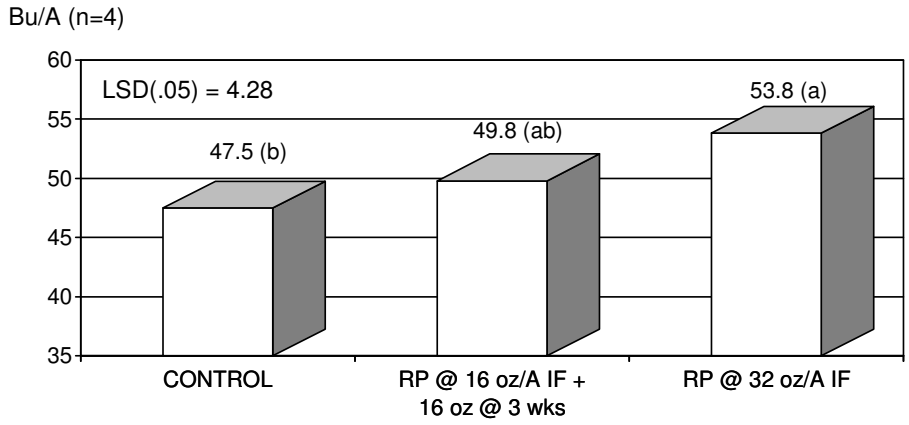
A significant yield increase was observed with the 32 oz/A in-furrow rate (Figure 8). Since seed size studies indicated no increase in bean size, the yield increase was likely due to more beans per acre rather than larger beans.

While the 16 oz + 16 oz treatment provided some yield enhancement, it was not significant. This seems contrary to the C.I.R.T.A. findings. This may be an indication that higher rates are necessary on lighter soils. On heavier soils, such as

Figure 8. YIELD ENHANCEMENT IN SOYBEANS WITH RENEW PLUS™

MIDWEST 2100 SOYBEANS

Dr. E. S. Oplinger. University of Wisconsin. Hancock Research Station. Hancock, Wisconsin. 1997.



those at C.I.R.T.A., the higher 32 oz/A rate may be excessive even under conditions of above-average rainfall.

Grain Sorghum (Texas A&M University at Commerce, Texas)

A randomized complete block design with six replications consisting of 30-foot rows was used in this study which was planted at the Texas A&M University (Commerce, TX) Research Farm on May 3, 1997. The hybrid used was Honcho

sorghum. Seeds were treated with Gaucho. Following soil preparation, plots were planted with a two-row cone planter on a John Deere Max Emerge frame. Plots were seeded at 7 seeds per foot in 38-inch rows. One hundred pounds of 18-46-0 was applied in the row at planting and Counter 15G was applied at the rate of 8 oz/1000 feet of row .

Renew Plus was applied at two rates (8 and 16 oz/A) in the furrow through a Delavan 80-2R flat fan nozzle on May 4 with a CO_2 powered backpack sprayer after mixing with 10 gallons of water per acre.

Ammonium nitrate (34-0-0) was sidedressed on June 2 and cultivated into the soil. Stand counts were made on June 2 and vigor ratings were performed on June 10. The best 8 feet of each plot was harvested on August 19 and 20.

Differences were numerically different but not statistically significant largely due to plot variation. However, Renew Plus treatments showed greater stand and vigor than the control and the 16 oz/A treatment produced a 10% yield increase (Figure 9).

Figure 9. EFFECT OF RENEW PLUS™ ON STAND, VIGOR AND YIELD IN GRAIN SORGHUM

MEANS OF 6 REPLICATIONS
Department of Ag Sciences. Texas A&M University. Commerce, TX. 1997.

	CONTROL	RENEW PLUS @ 8 oz/A IF	RENEW PLUS @ 16 oz/A IF
Plants/25'	123	128	128
Vigor (1-5 scale)	3.0	4.2 (+40%)	4.0 (+33%)
Yield (Lbs/A)	2586	2481 (-4%)	2844 (+10%)

1998 STUDIES

The weather in 1998 presented U.S. farmers with substantial challenges with drought in the South central U.S. and excessive rainfall in many areas of the North.

Under these conditions, 1998 test plots in both geographical areas again sought to reference and validate previous results while expanding research to include sorghum, cotton, sugar beets, and potatoes.

Studies on sorghum, corn and cotton were established at the Cooperative Research Project at Texas A&M University at Commerce, Texas. The corn was drought-stricken and completely burned out by the end of July. The cotton plots were severely impacted and gave erratic lint yields such that plot data was unrepresentative and unreliable. Only the grain sorghum plots provided adequate data.

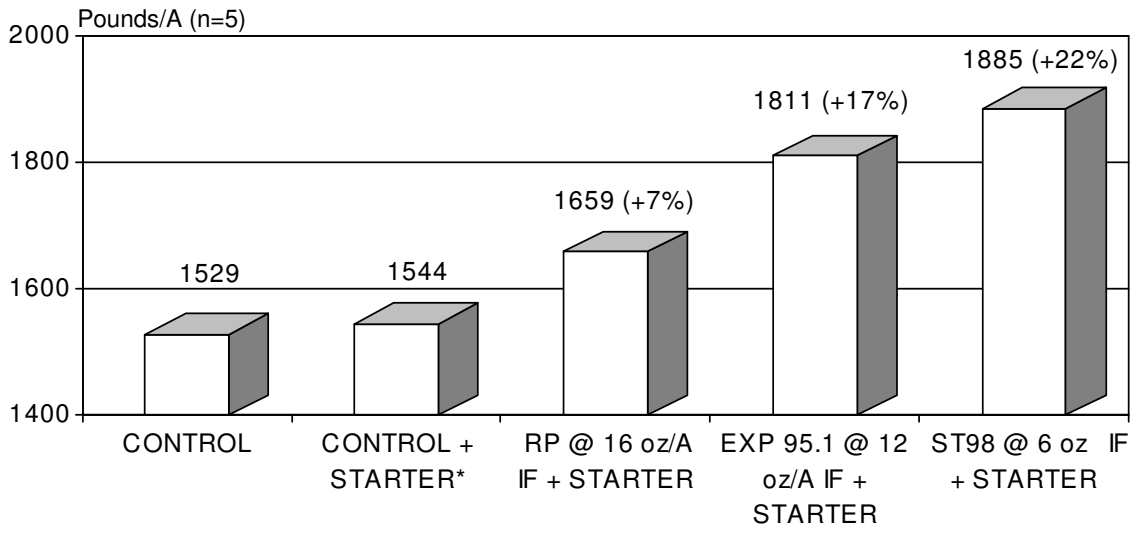
Grain Sorghum (Texas A&M University at Commerce, Texas

The design, plot plan, hybrid and procedure were the same as in the 1997 plots except that instead of 100# of 18-46-0, 9.6 gpa of 10-34-0 was applied in-furrow with the treatments. The study was installed on May 13, 1998.

Again, plot variation prevented emergence of statistically significant differences. However, numerical differences were pronounced (Figure 10). Results with the untreated control and control + starter showed that the starter by itself provided no advantage. However, adding 16 oz/A of Renew, 12 oz/A of EXP 95.1 (an experimental fertilizer additive), or 6 oz/A of ST-98 (an experimental seed treatment) to the starter gave numerical increases of 7%, 17% and 22%, respectively.

Figure 10. EFFECT OF AGPRO PRODUCTS ON YIELD IN GRAIN SORGHUM

MEANS OF 5 REPLICATIONS.
Department of Agricultural Sciences. Texas A&M University. Commerce, TX. 1998.



* 10-34-0 @ 9.6 gpa in-furrow (IF)

Midwest Studies

Studies were installed at C.I.R.T.A. at Parkersburg, IA for the third season. Again, similar studies were initiated in sandier soils at the University of Wisconsin's Hancock Research Station for the second season.

Field Corn (C.I.R.T.A.)

A warm, dry May allowed for excellent planting conditions. Corn emerged on May 19, eight days after planting. Unfortunately, June ended with 11.25 inches of rainfall for the month, which was three times normal. Furthermore, a drainage problem caused stunting and yellowing. A rescue treatment was applied on July 6. It appeared to be too late to produce an improvement in plant growth or color.

Then, less than 1/2" of rain fell in all of July and only 2.47 inches fell in August. The result was grain yields in all treatments similar to the untreated control.

Field Corn (U. of Wisconsin)

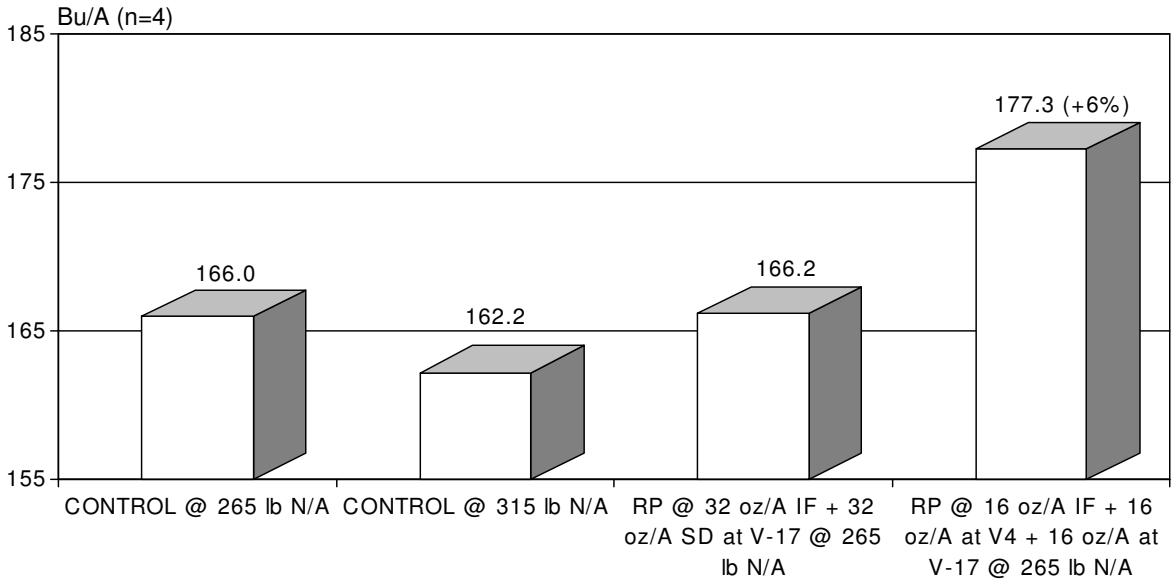
Dr. Oplinger again installed a study with the same experimental design and protocol, extending last season's study. He used a 32 oz/A in-furrow treatment to evaluate the effects of a higher rate, since 16 oz/A in-furrow last year seemed insufficient and, in fact, gave a yield decline (Figure 6). Due to excess rainfall at this location, it was decided that an additional in-furrow sidedress should be given to both treatments on 16 July to counteract the effects of leaching.

It is assumed that the extra Renew Plus was excessive in this growing environment which was better drained and which also received less rainfall than eastern Iowa. The 32 oz/A rate proved no better than the control while the 16 oz/A in-furrow rate followed by 16 more ounces 3 weeks afterward again proved the best for a second year in a row. A nearly-significant 11.3 bushel increase was seen with this rate. It is thought, however, that the additional 16 oz/A sidedress at V-17 was also excessive under these conditions and prevented emergence of greater yield differences (Figure 11).

Figure 11. YIELD ENHANCEMENTS IN FIELD CORN WITH RENEW PLUS™

NOVARTIS 4242 HYBRID

Dr. E.S. Oplinger. University of Wisconsin. Hancock Research Station. Hancock, WI. 1998.



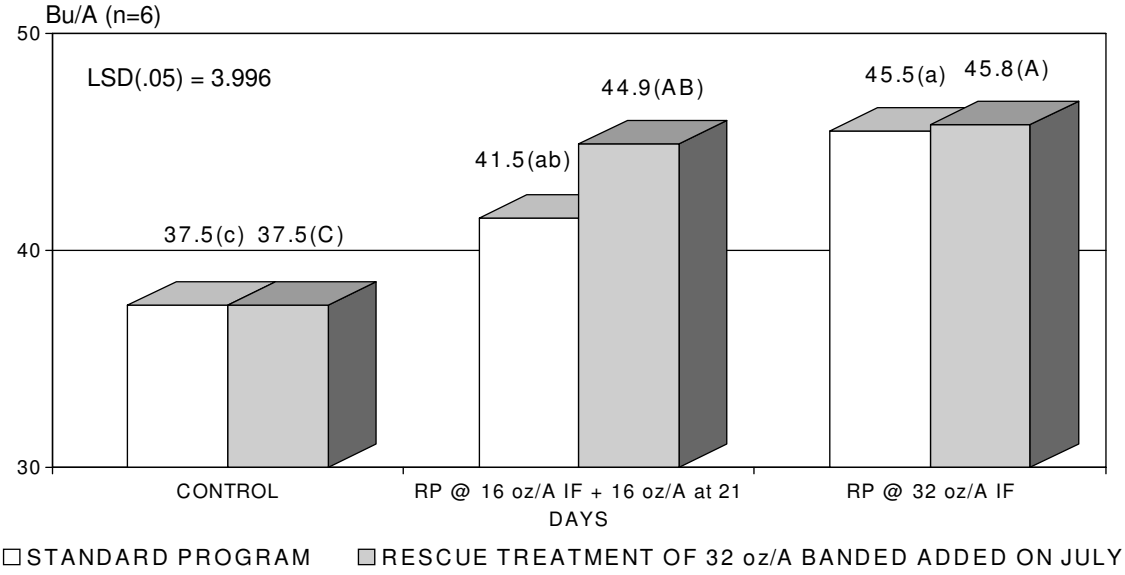
Soybeans (C.I.R.T.A.)

Dr. Boukerrou duplicated last year's study to verify the efficacy of the 32 oz/A in-furrow and sidedress rates. Design and procedure were the same except Stine 2250 soybeans were used and Galaxy and Poast Plus herbicides replaced Roundup and Roundup Ultra. Planting took place on May 11. However, the drainage problem and 11 inches of rain in June also presented an opportunity for a rescue treatment on July 6 which consisted of an additional 32 oz/A applied sidedressed to two of the rows on the south side of each plot. This enabled a comparison between two rows receiving the additional rescue treatment to two rows receiving only the standard treatments. Plots were cultivated on the same day.

Both the standard 16 oz/A in-furrow plus 16 oz/A at 21 days after planting and the 32 oz/A in-furrow applications produced significant yield enhancement over the controls. The additional 32 oz did nothing for the control receiving no previous treatment. Nor did it enhance yield over the standard 32 oz/A in-furrow treatment. It did cause a non-significant 3.4 bushel increase over the standard 16 + 16 treatment, however (Figure 12).

Figure 12. YIELD ENHANCEMENTS IN SOYBEANS WITH RENEW PLUS™ APPLIED AS A RESCUE TREATMENT

STINE 2250 SOYBEANS
Center for International Research and Training in Agriculture. Parkersburg, IA. 1998.



Means followed by the same letter do not differ significantly (P<0.10)

Note that in last year's study (Figure 7) that the 16 + 16 program also gave significant increases while the 32 oz/A program did not. It appears the extra rainfall made the 16 + 16 program a bit more advantageous, while the disadvantage of the usually-excessive 32 oz (+32 oz Rescue) was ameliorated.

Soybeans (U. of Wisconsin)

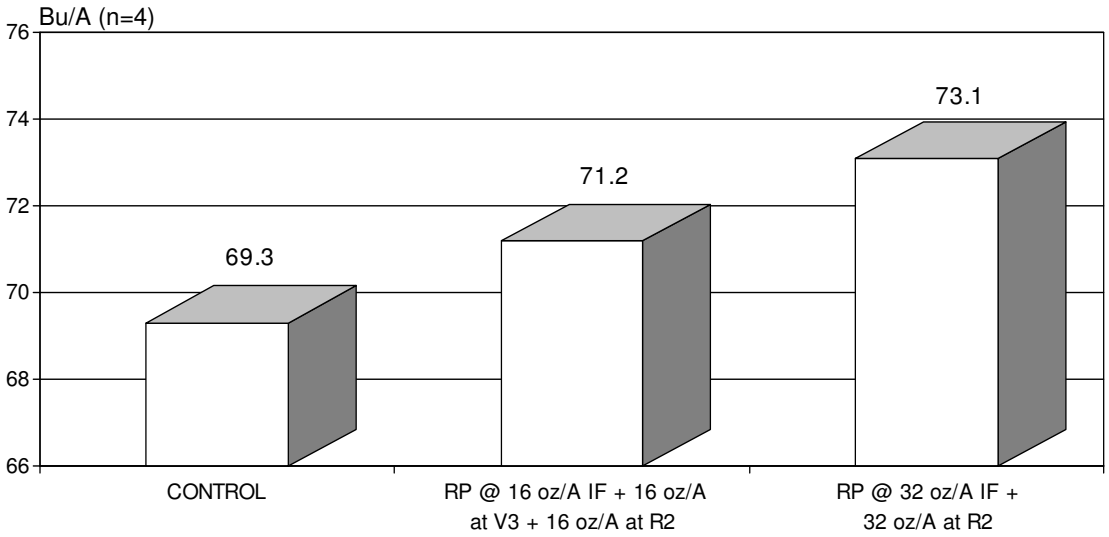
A similar case appears likely in Dr. Oplinger's second study on a Plainfield sand further east in Wisconsin, where rainfall and drainage were not quite the problem at Parkersburg. This was also a repeat of the 1997 study for Dr. Oplinger, except that Novartis S20-B9 soybeans were used this time.

The high rate again gave the greatest yield. It should be noted, however, that yields were outstanding at this location this year, regardless of treatment, and any treatment which can enhancement of soybean yields averaging over 65 bushels per acre is noteworthy (Figure 13).

Figure 13. YIELD ENHANCEMENT IN SOYBEANS WITH RENEW PLUS™

NOVARTIS S20-B9 SOYBEANS

Dr. E.S. Oplinger. University of Wisconsin. Hancock Research Station. Hancock, WI. 1998.



Sugar Beets (U. of Minnesota)

Dr. Larry Smith of the University of Minnesota's Northwest Experiment Station in Crookston, Minnesota studied the effects of Reclaim (RC-98) on sugar beets grown in the clayey soils on the Experiment Station in Crookston. This is intended to be a multi-year study utilizing the same plots for the same treatments in order to monitor long-term benefits and changes in soil structure.

Reclaim is designed to moderate soil crusting. Anecdotal data indicates it may lessen the girdling of the best tops by soil crusting, which retards flow of storage photosynthate to the beet, this hampering yields. Reclaim may soften soils, but it may also enhance plant vigor by promoting greater root growth and access to water and nutrients. Anecdotal testimony also indicates it may reduce loss to molasses as well as reduce sodium and amino-nitrate content in sugar beets.

Field trials by American Crystal Sugar Company of East Grand Forks indicates increased tonnage, sugar content, and recoverable sugar per acre and lower sodium and loss to molasses in Reclaim-treated fields compared to the previous 4 years of conventional production on the same field (Call, 1997).

To test these observations, replicated trials were installed by Dr. Smith.

He found that RC-98-treated plots had higher recoverable sucrose and tonnage, higher % sucrose and potassium, and lower loss to molasses, lower sodium, lower amino-nitrate, and lower nitrate grade where 32 oz/A of Reclaim were applied broadcast, pre-plant incorporated with 32 oz/A applied banded prior to emergence.

Figure 14 shows an average 1.30 ton per acre increase where the 32 + 32 program is used on heavy soils.

Figure 14. YIELD ENHANCEMENT IN SUGARBEETS WITH RECLAIM

BEET YIELD PER ACRE

Dr. L. Smith. University of Minnesota. Northwest Experiment Station. Crookston, MN. 1998.

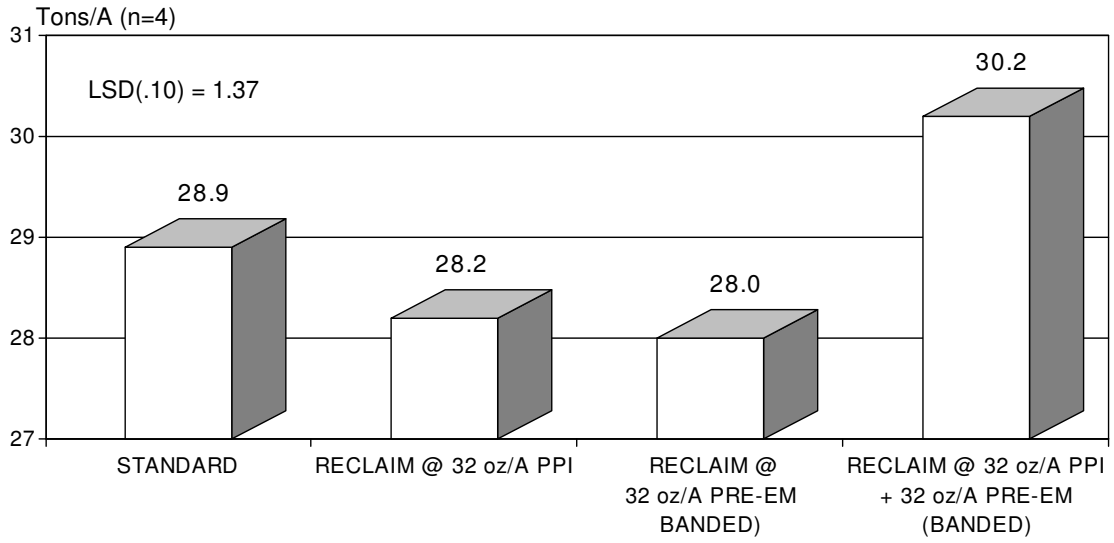


Figure 15 shows an average 654 lb per acre increase in net sugar where this program was applied.

These differences were near the 10% level of significance.

An interpretation of the analysis of soils from Dr. Smith's plots seemed to indicate that Reclaim affected soil chemical properties.

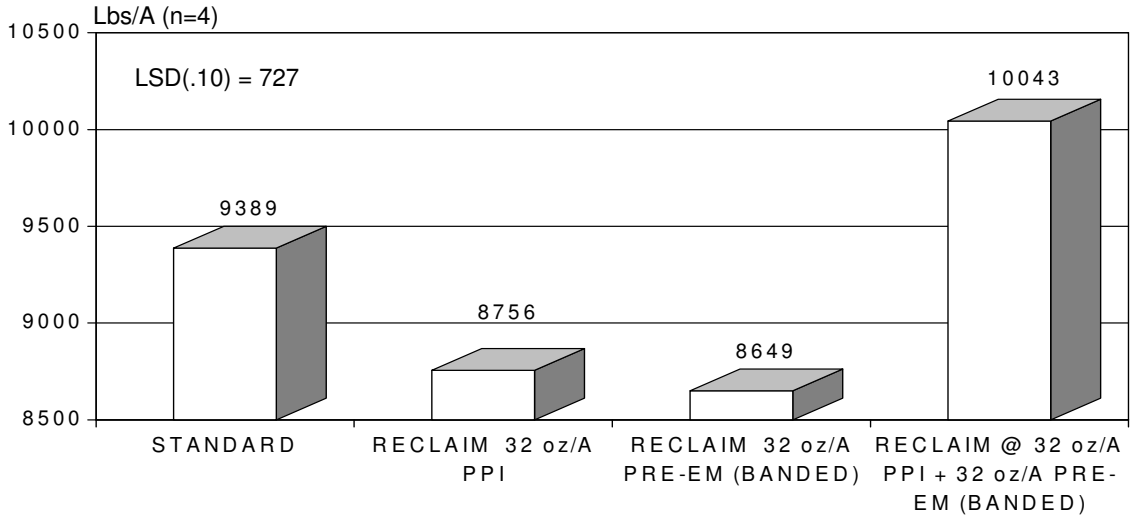
Treatment with 32 oz./A applied broadcast, pre-plant incorporated (BPPI) plus 32 oz./A applied banded, pre-emerge increased measurable soil organic matter (O.M.), P1 and P2 phosphorus, while available potassium, magnesium, sodium and pH decreased.

Changes in soil chemical properties with Reclaim treatment will be a topic of future research.

Figure 15. YIELD ENHANCEMENT IN SUGARBEETS WITH RECLAIM

NET SUGAR PER ACRE

Dr. L. Smith. University of Minnesota. Northwest Experiment Station. Crookston, MN. 1998.



Cotton (Farmland Industries, Technical Services)
Technical Service Manager Charles Denver at South Delta Farmers Association at Dermott, AR installed a replicated trial with Renew on Suregrow 125 cotton.

Planting was on May 15, 1998. A control and three treatments of Renew (RN-98) were used. N, P, and K were applied pre-plant at the rates of 40, 60, and 90 pounds per acre, respectively, followed by 45 pounds per acre of nitrogen at first bloom.

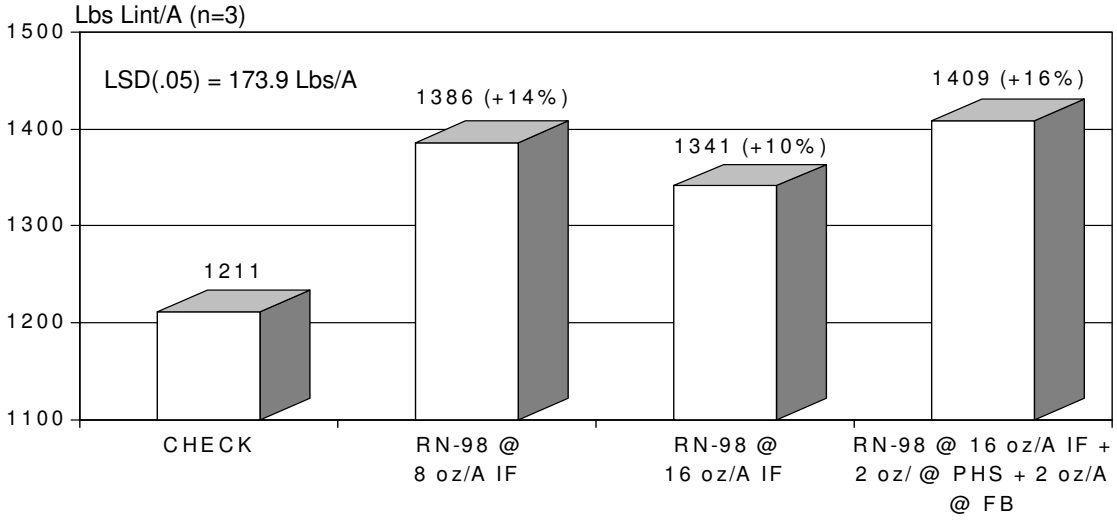
Stand, boll size, boll numbers, and yield were monitored. Root growth was evaluated at the 5th leaf stage and again at pinhead square.

All Renew treatments increased root growth measurably.

Renew at 16 oz. per acre applied in-furrow plus 2oz. per acre at pin-head square and again at first bloom increased lint yield an average of 198 pounds per acre (Figure 16).

Figure 16. EFFECT OF RENEW(RN-98) ON YIELD OF SUREGROW 125 COTTON

FARMLAND INDUSTRIES TECHNICAL SERVICES.
Charles Denver. South Delta Farmers Association. Dermott, AR. 1998.



Potatoes (U. of Minnesota)

Dr. Marvin Mattson of the Department of Agronomy at the University of Minnesota at Crookston established a study to determine the effect of Reclaim (RC-98) and Renew Plus (RPL-98) on yield, quality, grade and early and late blight in Russett-Burbank potatoes. Six treatments were applied: a control, Reclaim at 32 oz per acre broadcast prior to bedding, Renew Plus banded beside the furrow at planting, the two above combined, this combination plus Reclaim at 32 oz per acre surface applied between the beds 3 weeks after emergence and before row closure, and Reclaim surface applied (alone) between the beds 3 weeks after emergence.

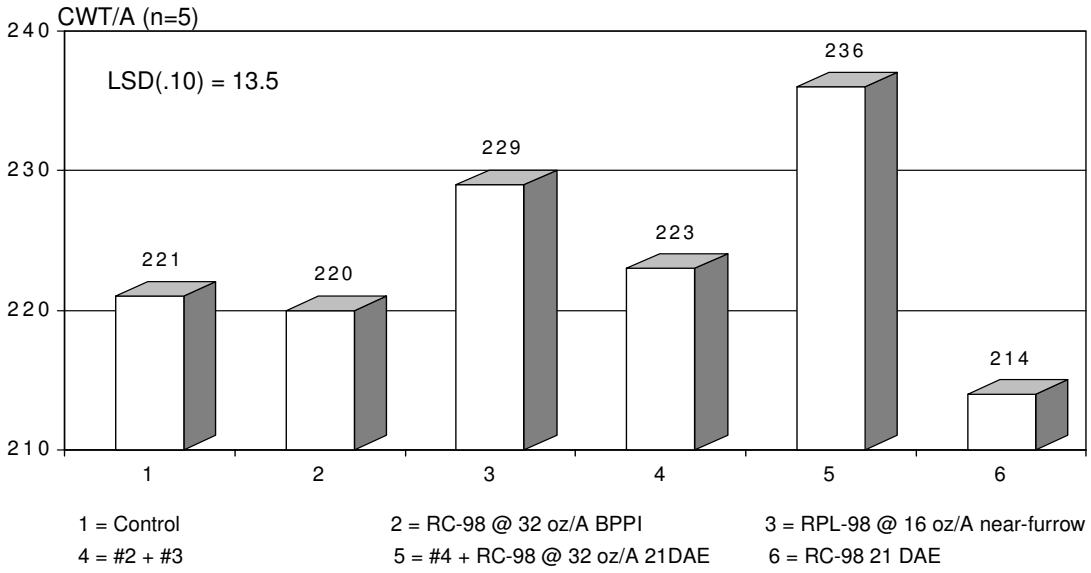
The trial was installed on May 27, 1998 using a 6-nozzle bicycle sprayer, Goldrush variety potatoes; N-P-K-S at 110, 60, 80 and 30 pounds per acre, respectively; and Bravo + Mancozeb and Furadan for pest control. The soil was a sandy clay loam with 31% sand, 28% silt, and 41% clay.

No significant differences were observed between treatments in early or late blight. Neither were there significant differences in vigor or number and quality of tubers.

Treatments with Reclaim at 32 oz per acre broadcast + Renew Plus at 16 oz per acre near-the-furrow + Reclaim at 32 oz per acre 3 weeks after emergence had the highest yield, followed by Renew Plus at 16 oz per acre near-the-furrow and then by Renew Plus + Reclaim pre-plant (Figure 17).

Figure 17. YIELD ENHANCEMENT WITH RECLAIM AND RENEW PLUS IN RUSSET-BURBANK POTATOES

YIELD IN HUNDRED WEIGHT.
Dr. Marvin Mattson. University of Minnesota. Crookston, MN. 1998.



Yields were numerically different and nearly reached the 5% level of significance. Because of planting operations, Renew Plus was not applied directly on the seed potatoes as intended, which should have made a greater difference. This treatment will be applied as intended in future trials.

Soil Physical Properties

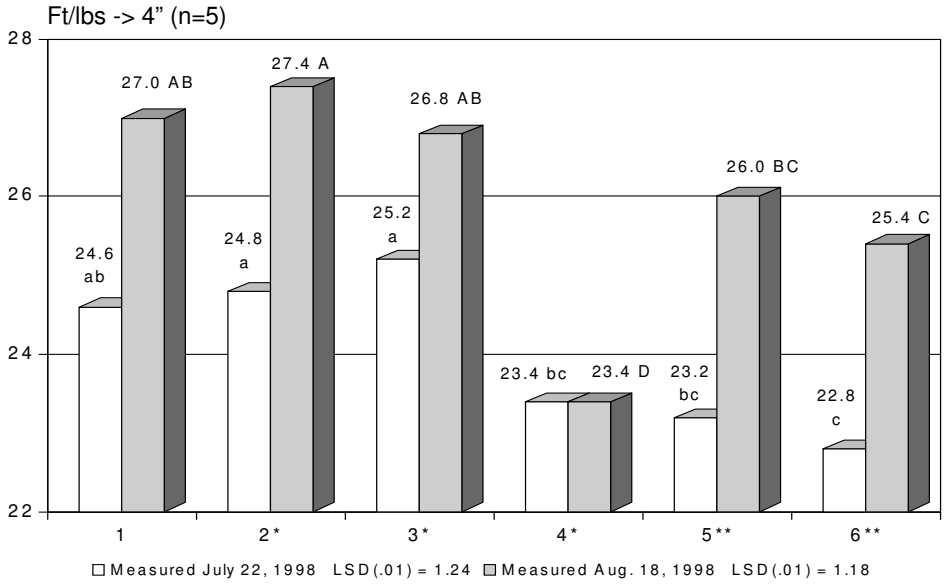
Dr. Mattson also used a push scale meter to monitor soil density variation with treatments. Readings were taken to a depth of 4 inches.

On both observation dates treatments 4, 5 and 6 had lower readings indicating decreased density (“hardness”) with 32 oz of Reclaim + 16 oz of Renew Plus + 32 oz of Reclaim at 21 days after emergence (DAE) and 32 oz of Reclaim applied at 21 days DAE.

Significant differences were observed at the 1% level (Figure 18).

Figure 18. EFFECT OF RECLAIM TREATMENTS ON SOIL DENSITY AS MEASURED BY PUSH METER READINGS

SANDY CLAY LOAM IN RUSSETT-BURBANK POTATO TEST PLOTS.
Dr. Marvin Mattson. University of Minnesota. Crookston, MN. 1998.



Treatments: See Figure 16

* Applications on May 27 ** Application in week of June 7

This decrease in soil density with Reclaim treatment has been observed before in the field and noted anecdotally, but this is the first time it has been documented by replicated sampling by a third-party research cooperator.

Indeed, a preliminary study by Dr. Jerry King (1999) of Midwest Laboratories seems to confirm that Reclaim influences soil physical properties. In a replicated laboratory study using sugar beet soil from the Peterson Farm near Grand Forks, Minnesota, it was found that Reclaim enhances penetration of water in treated soils. Using the equivalent of 32 and 64 oz per acre of Reclaim spray applied to the surface of two series of test pots, it was observed that changes in the soil surface caused more rapid penetration of subsequent applications of water to the pots treated with Reclaim. Furthermore, treated soils expanded more rapidly than control soils due to water filling the soil pores more thoroughly.

Greater soil permeability would certainly result in decreased density and decreased "hardness". This represents an important finding which will be studied further in future research.

1999 STUDIES

Weather was again a factor that limited production at many locations. At Texas research locations, the 1999 growing season was similar to 1998, which was the hottest and driest year on record. Texas has now suffered through three years of

drought in the last four. The yields of all crops in the region were markedly reduced by this phenomenon, and differences in field studies which may have been present were likely masked by adverse environmental conditions.

Cotton (Texas A&M University – Commerce, Texas)

Three studies of AgPro products on cotton were completed in 1999. The hardest hit were the plots at Texas A&M – Commerce.

This trial was planted (variety: TAMCOT Sphinx) at the TAMU-Commerce research farm in Neylandville on May 24, 1999, with two cone planters mounted on a 2 row Maxemerge frame. The plots were seeded at 7 seeds per foot in 38: rows. The entire experiment was treated with Temik 15G @ 4 lb./acre to suppress early season thrips. The pressure on the planter press wheels was reduced to leave the furrow partially open for the in-furrow treatments. The in-furrow treatments were applied immediately after the experiment was planted.

Following planting, there was a very wet period. May 25 – .25", May 26 – .80", May 28 – .25", May 30 – .90", May 31 – 1.00". Unacceptable stands developed, and the experiment was replanted on June 7. All the steps listed earlier were repeated for the replanted experiment.

The in-furrow treatments (treatments 2, 5, 6, 7, and 8) were applied immediately after planting with a one-nozzle boom powered by a backpack CO2 sprayer. The materials were mixed in 6.5 g.p.a. water and applied through a Delavan 80-2R flat-fan nozzle positioned with the fan along the row. Plot size was four rows, 30 feet long, and the experimental design was a randomized complete block with six replications. Environmental conditions on the first (at planting) applications were as follows: temperature - 91ºF, relative humidity – 61%, wind 2.5 mph.

The following treatment were applied:

Treatment	Application Type	Timing
1. Untreated check	-	-
2. RN99 @ 16 fl. Oz./A	In furrow	At planting
3. RN 98 @ 2 fl. Oz./A	Broadcast	Pinhead, boll set
4. RC99 @ 32 fl. Oz./A	Foliar band	24 DAE (July 6)
5. Trt. #2 + Trt. #3	See above	See above
6. Trt. #2 + Trt. #3 + Trt. #4	See above	See above
7. ST99 @ 6 fl. oz./a	In furrow	At planting
8. Trt. #7 + Trt. #4	See above	See above

Conditions at the other applications were as follows:

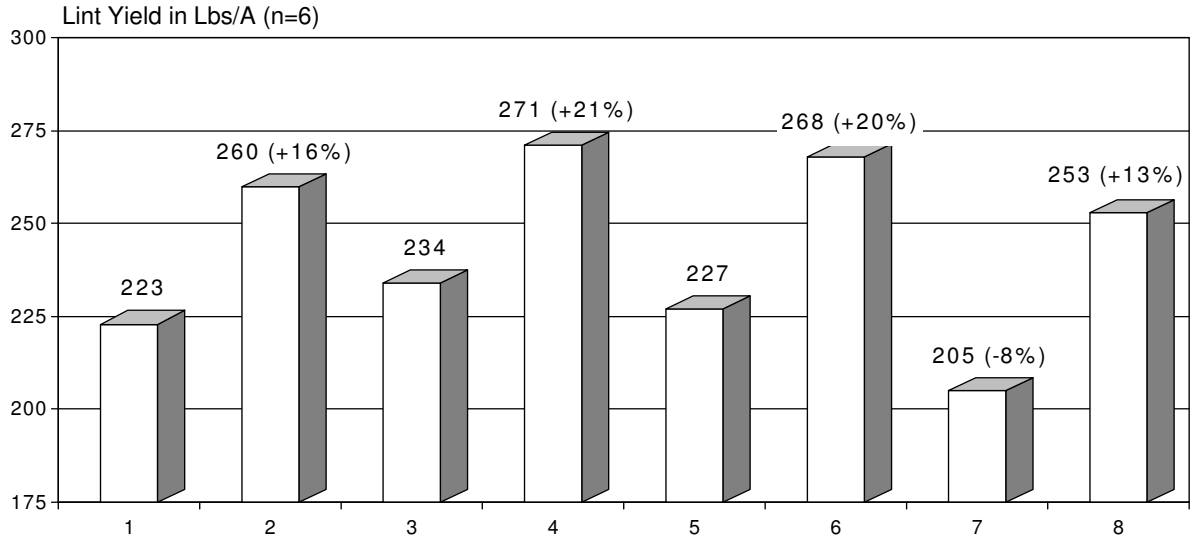
Treatment Timing	Temperature ºF	Rel. Humidity %	Wind Speed
25 DAE (July 6)	101	29	2.9
Pinhead square (July 9)	88	52	3
Boll set (July 22)	86.8	63	7

Ammonium nitrate (300 lb. Of 34-0-0) was sidedressed on June 24, and cultivated in on the same day. Yields were determined by harvesting the seed cotton from 8 row feet in the left row of each plot. The seed cotton was picked by hand on October 6 and ginned with a 10-saw laboratory gin.

Extreme dryness throughout the summer limited yields to about half the normal levels and statistically significant ($P < .05$) difference did not emerge. However, some important trends were identified. Treatments which included Reclaim (RC-99) gave lint increases ranging from 13% to 21% over the control, and treatments which included Renew (RN-99) gave lint increases ranging from 16% to 20%. The seed treatments (ST-99) and the additional foliar applications seemed to depress yields (Figure 19).

Figure 19. EFFECT OF AGPRO PRODUCTS ON COTTON YIELDS

Department of Ag. Sciences. Cooperative Research Project.
TAMU - Commerce. 1999.



Future studies should include the 32 oz/A rate of Reclaim with and without two rates of Renew (8 oz/A and 16 oz/A) applied in-furrow, as these treatments seem to have the greatest potential for good yield increases.

Cotton (Texas A&M Research & Extension Center, Chillicothe-Vernon-Munday)
In contrast with the test location at Commerce, these plots were irrigated. The trial layout was a randomized complete block design with 4 replications and six treatments. The treatments applied were:

Treatment	Application Type	Timing

1. Check		
2. RC98 @ 32 oz/A	Banded, incorporated	Pre-plant
3. #2 + RN98 @ 16 oz/A	Banded (2" – 4")	Post-plant
4. #3 + CB99 @ 12 oz/A	Foliar	With 1 oz Pix
5. #4 + 2 lb/A 10-45-10	Foliar	3x=EB, FB, BE
6. RC-98 @ 32 oz/A	Banded between beds	21 DAE

* EB = Early bloom FB = Full bloom BE = Boll enlargement DAE = Days after emergence

On May 18, 1999 RC-98 was applied to treatments 2, 3, 4 and 5 and incorporated and TAMCOT Sphinx was planted the same day using a Maxemerge planter dropping 5.3 seeds per foot of row on 40" rows. Later that day, RN-98 was applied at 16 oz/A to treatments 3, 4 and 5.

By May 24, cotton was emerging, but storms damaged the seedlings soon after emergence. The original –planting was retained, however, since wet fields and the previous applications made replanting impractical. Treatment 6 (RC-98 @ 32 oz/A) was sprayed between rows on a 20-inch band 36 days after emergence when it was determined the stand would recover. This occurred on June 29.

Treatments 4 and 5 received applications of CB99 at 12 oz/A + Pix at 1 oz/A on July 13, August 2, and August 12.

Treatment 5 received 2 lbs/A of AgPro 10-45-0 on these same three dates in a separate application. The application of CB99 and 10-45-0 were broadcast over-the-top with 12 gallons of water per acre as a carrier.

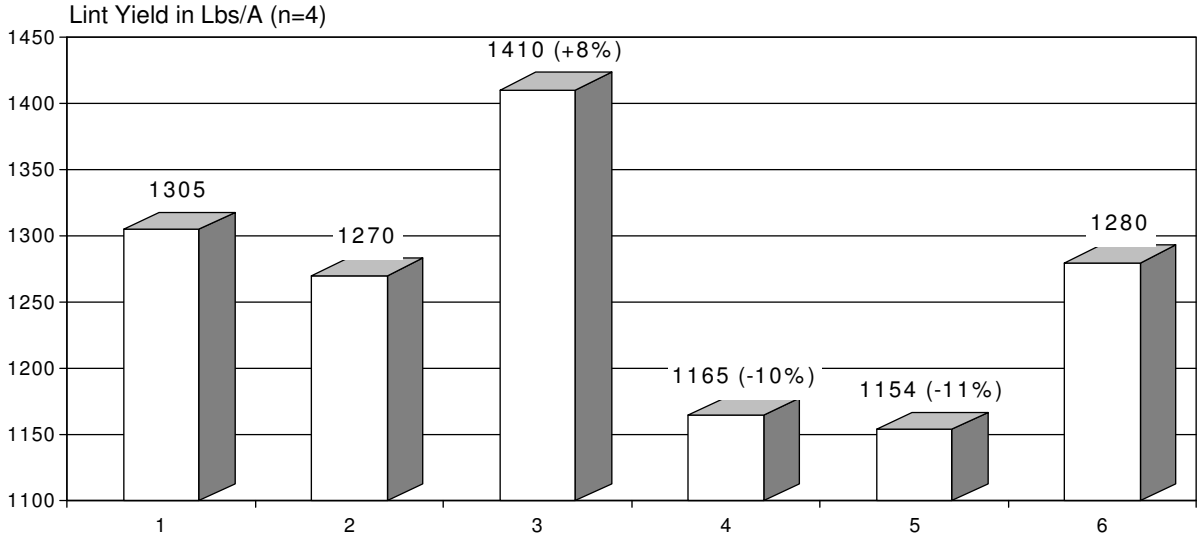
The test plots were irrigated on July 15 and 26, August 12 and 21, and September 1 for 6 to 8 hours per event. Pesticide applications were made based on extension service guidelines.

The plots were machine harvested on November 10 using a John Deere 282 stripper to take the entire 90" length of the two center rows of each plot. Samples were ginned at the Lubbock Research and Extension Center to get percent lint.

Yields were exceptionally high, but no statistically significant differences were observed among treatments for plants / row-ft, bolls / row-ft, lint percent, or lint yield. Numerical differences and trends did appear, however. The Reclaim (RC98) treatment at 32 oz/A + Renew (RN98) at 16 oz banded over the furrow after planting gave a yield increase of 105 pounds of lint per acre compared to the control, an 8% increase. As in the previous cotton study, CB99 at 12 oz/A with 1 oz of Pix tended to depress yield by 10% to 11% (Figure 20).

Figure 20. EFFECT OF AGPRO SYSTEMS PROGRAMS ON COTTON YIELD

Texas Agricultural Experiment Station. Texas A&M Research and Extension Center at Chillicothe - Vernon, TX. 1999.



Future studies should focus on applications of RC and RN together, but with RC at a lower rate if it is banded over the beds and with 3 rates of RN, with and without CB – also at a reduced rate.

Cotton (Farmland Industries Technical Services)

A randomized, replicated study on RN 98 and CB99 was established by Charles Denver, Technical Service Director, Farmland Industries at Dermott, Arkansas on irrigated cotton.

Stoneville BXN47 was planted on May 7, 1999. The treatments were as follows:

Treatment	**Application**	**Timing**
1. Check and 2 # 10-45-10	In furrow	At planting , on seed
2. RN98 @ 8 oz/A	In furrow	On seed
3. #2 + 2 oz/A RN98	Foliar	All foliars, PHS, BS
4. RN98 @ 16 oz/A	In furrow	On seed
5. #4 + 2 oz/A RN98	Foliar	All foliars, PHS, BS
6. Untreated check	-	-

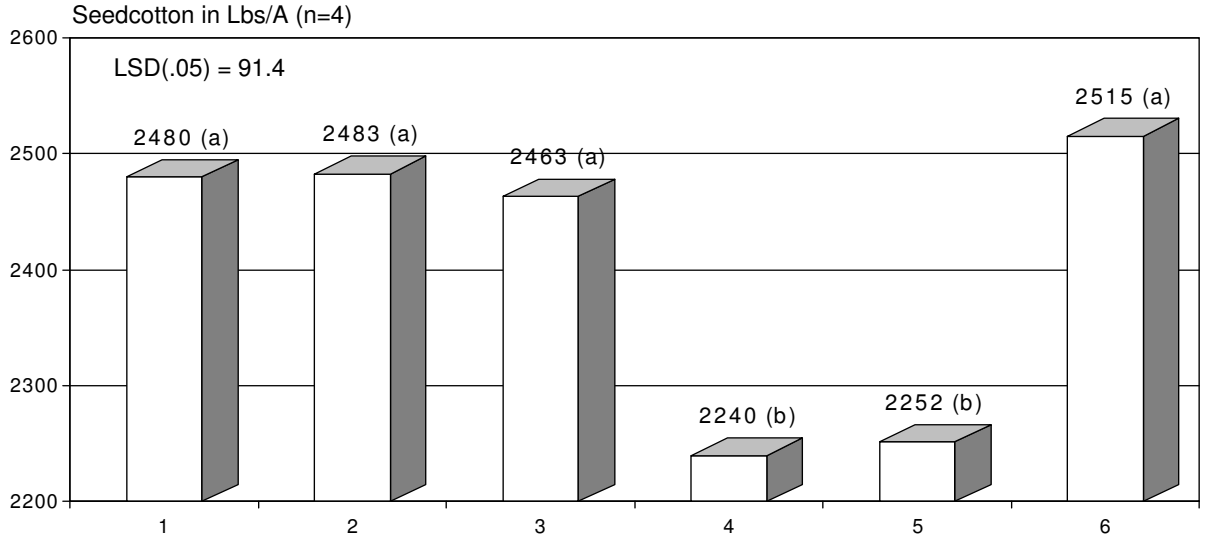
In addition, treatments 1-5 received 12 oz/A of CB-99 + 1 oz/A of Pix, applied on July 8, 16, 24, and August 6 and 17. The untreated check (Treatment 6) received two 8 oz/A applications of Pix on July 8 and 24.

Significant differences in yield of seedcotton did appear, with treatments #4 and #5 having significantly lower yields than all other treatments, including the two controls (Figure 21). RN98 @ 16 oz/A in-furrow was present in both these

treatments, and it is possible that this rate is too high in these rich, alluvial soils. However, the yield of all treatments receiving CB99 @ 12 oz/A + 1 oz/A Pix five times during the season were depressed compared to the untreated check.

Figure 21. EFFECT OF RN98 and CB99 ON COTTON YIELD

Charles Denver. Farmland Industries Technical Services. Dermott, AR. 1999.



Means not followed by the same letter differ significantly (P < 0.5)

It appears that a pattern is emerging with regard to CB99 applications: it is that at 12 oz/A, the rate is much too high.

Future studies here should utilize 8 oz/A and 16 oz/A treatments of RN98 and 8 oz/A and 16 oz/A of RC99. The CB99 should be studied at 6 oz/A and 3 oz/A with 1 oz/A of Pix.

Corn (University of Wisconsin)

Research trials were established on RP98 at two university research stations by Dr. Edward Oplinger. These were randomized complete block designs with four replications and five treatments.

Treatments consisted of two controls at a (1) 150 lb/A nitrogen rate and another at (2) 200 lb/A nitrogen rate, (3) RP98 at 16 oz/A in-furrow at planting + 16 oz/A sidedressed at 21 days (4) RP98 at 32 oz/A in-furrow at planting, and (5) RN98 at 16 oz/A in-furrow at planting + 16 oz/A side-dressed at 21 days.

At the Hancock Agricultural Experiment Station at Hancock, Wisconsin the soil is a Plainfield Sand to which large amounts of fertilizer are routinely applied. The AgPro treatments were applied to plots with excessive nitrogen content (200 lb/A of N) and no differences were observed between the two nitrogen rates or the treatments. The yield average for all plots was 203.7 bushels per acre.

Excessive nitrogen fertilization will negate the effect of both Renew (RN) and Renew Plus (RP).

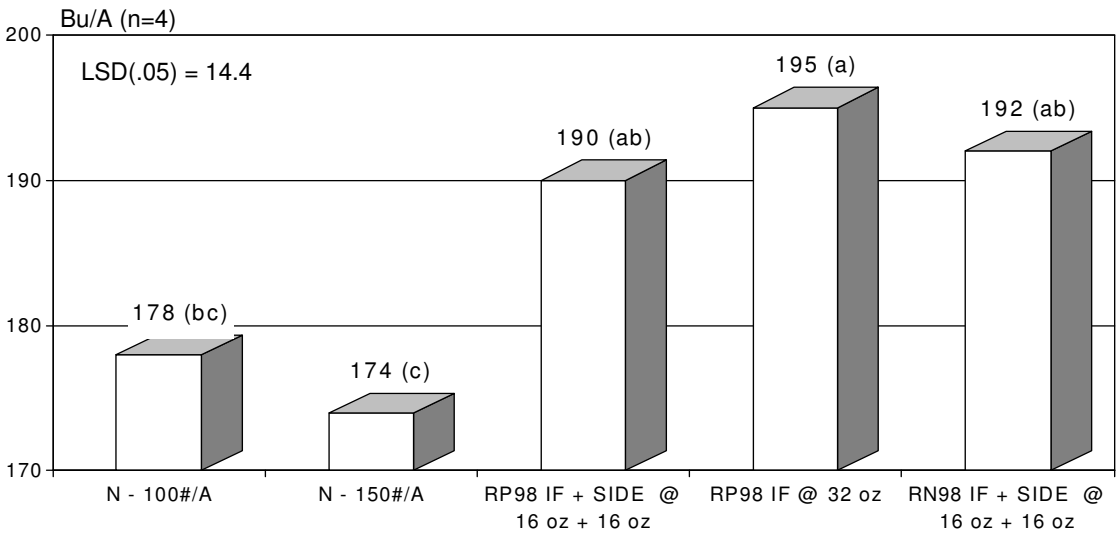
At the Arlington Agricultural Experiment Station, soils are neutral with 3.2% organic matter. The soil type is a Plano Silt Loam. The same experimental design and treatments were utilized. However, the two untreated controls were fertilized at 100 lb/A and 150 lb/A of nitrogen. The treatment plots were all on soils with the 150 lb/A rate of nitrogen.

Planting took place on May 20, 1999. Accent (0.33 oz/A) and Buctril (1.5 pt/A) were applied post emerge for weed control. Harvest was on October 20, 1999.

Significant enhancement of yield was evident with all AgPro treatments compared to the untreated control receiving 150 lb/A of nitrogen fertilizer (Figure 22). AgPro treatments 3, 4, and 5 gave 15.3 bu/A (+8%), 20.8 bu/A (+11%), and 17.7 bu/A (+10%), respectively.

Figure 22. EFFECT OF AGPRO PRODUCTS ON CORN GROWTH AND YIELD

ARLINGTON AGRICULTURAL EXPERIMENT STATION.
Dr. Ed Oplinger. University of Wisconsin. Arlington Research Station. Arlington, WI. 1999.



Soybeans (Farmland Industries Technical Services, Dermott, Arkansas)

Charles Denver, Technical Services Manager for Farmland Industries in Dermott, Arkansas, established a randomized study on RP98 with 12 treatments and 3 replications. The variety planted was Pioneer 9592. Plot size was 4-row strips. The plots were irrigated weekly starting July 17, 1999.

Treatments were as follows:
1. Usual and customary treatment

2. RP98 @ 16 oz @ 6 leaf stage
3. RP98 @ 16 oz @ 6 leaf stage + 16 oz 10 days later
4. RP98 @ 32 oz @ 6 leaf stage
5. RP98 @ 32 oz @ 6 leaf stage + 16 oz 10 days later
6. RP98 @ 16 oz/A in-furrow
7. RP98 @ 16 oz/A in-furrow + 16 oz @ 6 leaf stage
8. RP98 @ 16 oz/A in-furrow + 16 oz @ 6 leaf stage + 16 oz 10 days later
9. RP98 @ 32 oz/A in-furrow
10. RP98 @ 32 oz/A in-furrow + 16 oz @ 6 leaf stage
11. RP98 @ 32 oz/A in-furrow + 16 oz @ 6 leaf stage + 16 oz 10 days later
12. RP98 @ 32 oz/A in-furrow + 32 oz @ 6 leaf stage

Stand, test weight, and yield were monitored.

Stand counts were an average of 10 10-row foot counts per replicate. There were 3 reps per treatment. Test weights are samples taken from the combine at each plot. Yield figures are the machine-harvested yields per plot.

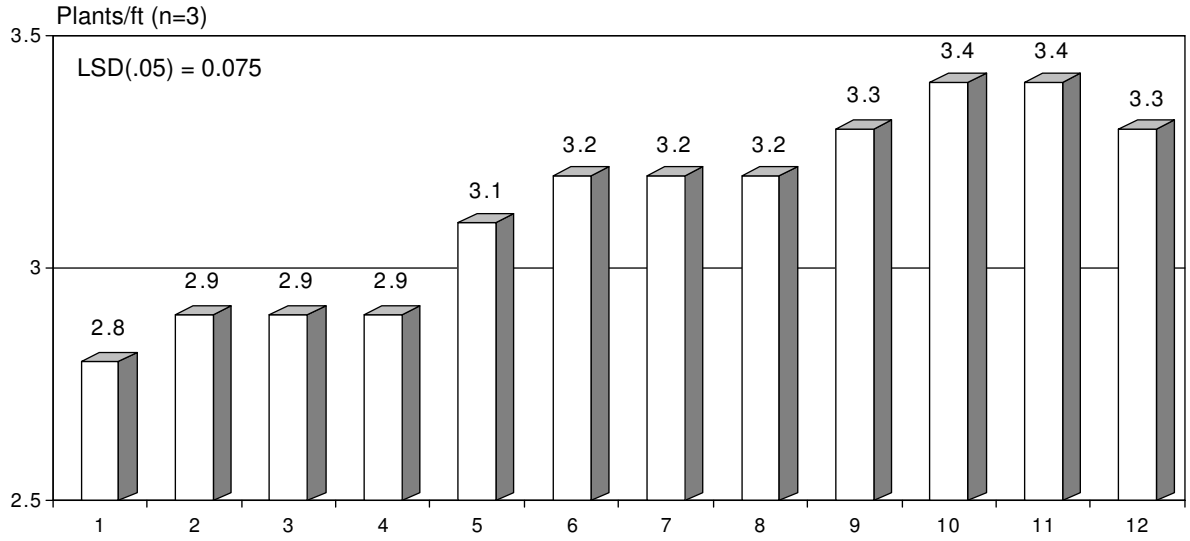
Significant differences were observed between treatments for stand, test weight, and yields.

The best stands were observed in treatments with the RP98 at 32 oz/A in-furrow (Figure 23).

Figure 23. EFFECT OF RP98 ON SOYBEANS

STAND COUNTS

Charles Denver. Farmland Industries Technical Services. Dermott, AR. 1999.

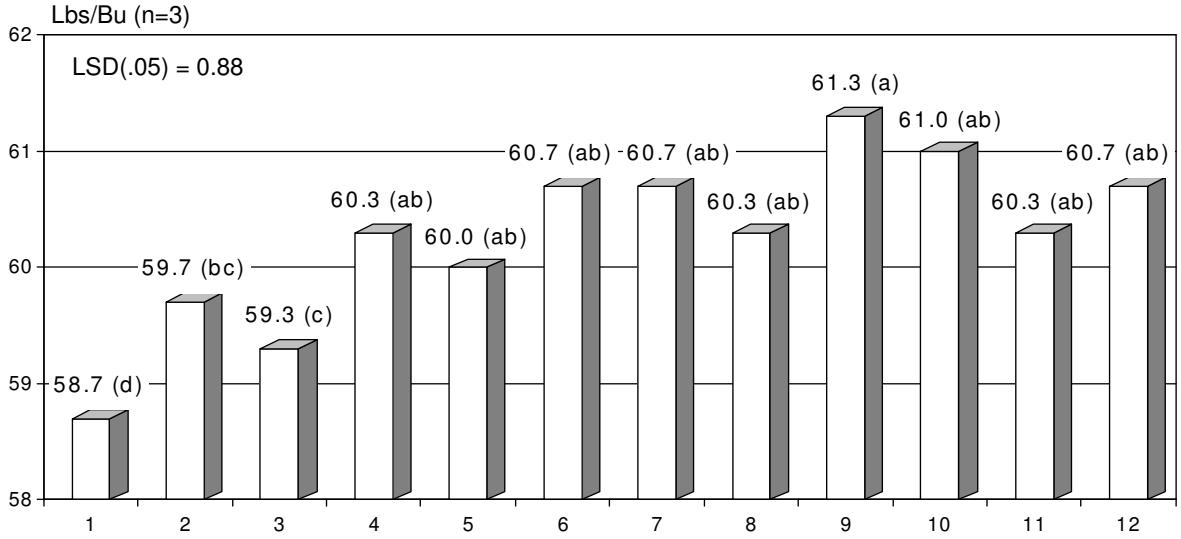


Test weights also differed significantly, with Treatment 9 (RP98 at 32 oz/A in-furrow) having the highest test weight. Generally, higher test weights were associated with in-furrow applications of RP98 (Figure 24).

Figure 24. EFFECT OF RP98 ON SOYBEANS

TEST WEIGHT

Charles Denver. Farmland Industries Technical Services. Dermott, AR. 1999.

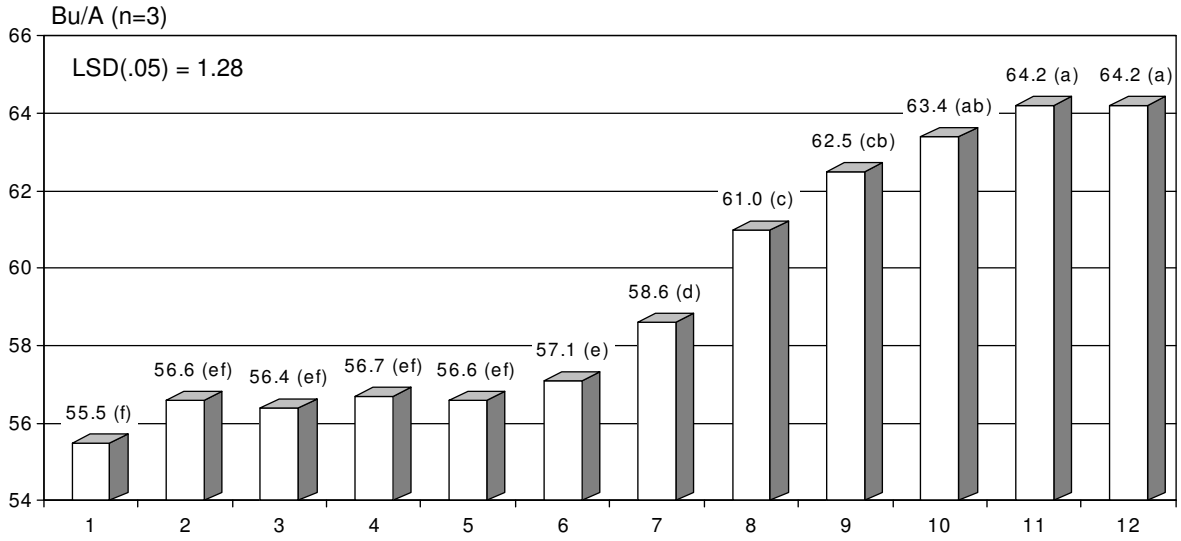


Highest yields were measured in plots that received RP98 at 32 oz/A in-furrow. Foliar treatment alone did not enhance yields. However, when they were paired with the 16 oz/A or 32 oz/A in-furrow treatments, there was yield enhancement. Such foliar treatments may not be cost effective, since the net effect is to add only one or two bushels per acre (Figure 25).

Figure 25. EFFECT OF RP98 ON SOYBEANS

YIELD

Charles Denver. Farmland Industries Technical Services. Dermott, AR. 1999.



Sugar Beets (Fehringer Agricultural Consulting)

A research trial was established on sugar beets in an irrigated field of cooperator Mike Gabel of Huntley, Montana. The study was performed by Neal Fehringer, certified professional agronomist, of Billings, Montana.

There were four treatments and three replications. The treatments consisted of a control, Reclaim, gypsum, and Reclaim + gypsum. The first quart of Reclaim and all gypsum were applied in early January 198. Beets were planted in mid-April at 230 seeds per 100 feet of row. The second quart of Reclaim was applied in early May. Beets were hand-harvested from 2-row x 6 feet plots (22 inch spacing) for 22 square feet and processed at the Western Sugar Factory at Billings, Montana.

Reclaim and Reclaim + gypsum demonstrated the highest gross income per acre with increases of $126.00 and $135.00, respectively (Figure 26).

Figure 26. EFFECT OF RECLAIM AND GYPSUM ON SUGARBEET YIELDS AND GROSS INCOME PER ACRE

Neal Fehringer. Fehringer Agricultural Consulting. Billings, MT. 1998.

Treatment	Reclaim Qts/A	Gypsum Tons/A	Yield Tons/A	Beets/100' of Row 4 Leaf	Harvest	% Sugar	Value $/Ton	Gross Income $/A
Check	0	0	27.26	96	86	15.01	36.312	990
Reclaim	2	0	29.63	101	97	15.38	37.660	1116
Gypsum	0	12	21.98	105	70	16.85	42.951	944
Reclaim / Gypsum	2	2	26.99	106	86	16.50	41.678	1125

Soil samples were taken before treatment and 10 months following treatment

The table below lists the initial composite soil test results taken before treatment. The table also contains soil test results from each of the treatments 10 moths after application. For each area sampled, 10 cores were taken. The pre-treatment and the 10 months post-treatment analyses were performed by Midwest Laboratories, Inc. of Omaha, Nebraska.

Changes in soil pH and sodium levels were observed, with the greatest changes resulting from applications of Reclaim and 2 tons per acre of gypsum (Figure 27).

Figure 27. EFFECT OF RECLAIM AND GYPSUM ON SOIL pH AND SODIUM LEVELS

Neal Fehringer. Fehringer Agricultural Consulting. Billings, MT. 1998.

Treatment	Depth	PH	Salts mmhos	Soil Test Levels, ppm				% Base Saturation			
				K	Mg	Ca	Na	K	Mg	Ca	Na
Pre-Treat	0-12"	8.5	1.8	244	654	2276	1243	2.7	23.8	49.8	23
Check	0-12"	8.3	2.9	248	593	1762	1482	3.1	23.7	42.3	30
Reclaim	0-12"	8.3	2.7	241	543	1704	1392	2.7	24.1	45.0	28
Gypsum	0-12"	8.4	2.3	218	571	1766	1078	3.0	25.3	46.9	24
Reclaim / Gypsum	0-12"	8.1	1.3	226	584	1672	887	3.3	27.6	47.3	21

Potatoes (University of Minnesota)

Dr. Marvin Mattson of the Department of Agronomy at the University of Minnesota at Crookston repeated the 1998 study of the effect of Reclaim and Renew Plus on potatoes (see Figures 17 and 18). This time, however, he used the Norkota variety.

The treatments were:

Treatments	Application	Timing
1. Check		
2. RC98 @ 32 oz/A	Broadcast	PPI
3. RPL98 @ 16 oz + 16 oz	Banded + foliar	June 11 + July 12
4. #2 + #3	See above	See above
5. #4 + RC @ 32 oz/A	See above + Banded	42 DAS (July 12)
6. RC98 @ 32 oz/A	Banded	42 DAS (July 12)

PPI = Pre-plant Incorporated, AP = At planting, DAS = Days After Seeding

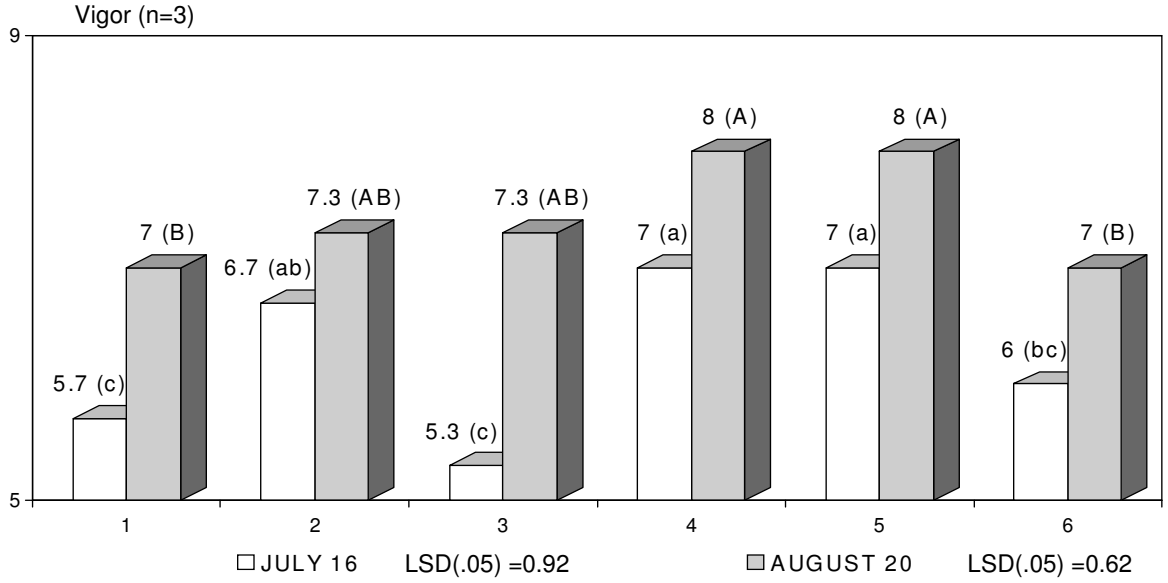
Treatments 2, 4, and 5 were applied as beds were being made and were thus incorporated to a depth of 5-6 inches. Planting occurred on May 29, 1999. Foliars were applied approximately 3 weeks later. RC98 applications in treatments 5 and 6 were banded between the rows 3 weeks later than recommended due to weather difficulties.

Treatments 4 and 5 produced plants which were visibly more vigorous on the July 16 and August 20 observation dates, scoring significantly higher on a scale of 10 than the control and the other treatments (Figure 28).

Figure 28. EFFECT OF RC98 and RPL98 on NORKOTA POTATOES

PLANT VIGOR

Dr. Marvin Mattson. University of Minnesota. Crookston, MN. 1999.

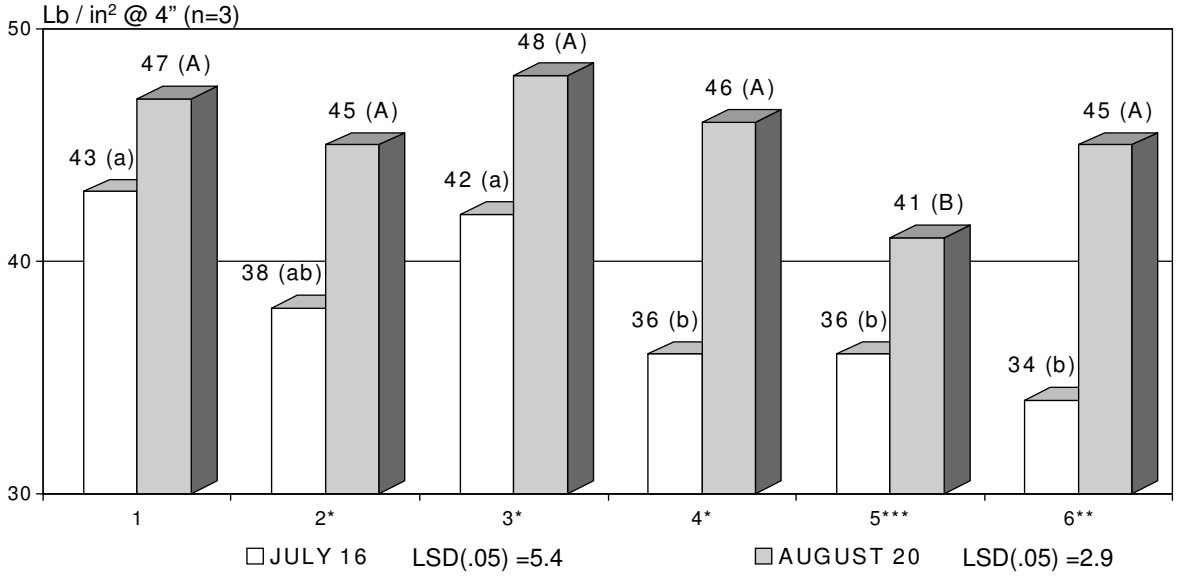


Dr. Mattson again used a push scale meter to check soil density variation at a 4-inch depth. Soils receiving Reclaim (RC) at 32 oz/A had lower readings, with the more recent application (42 DAS on July 12) showing the least density. By August 20, the effect had declined, indicating the "soil softening" caused by Reclaim lasts 30-45 days, after which another treatment may be appropriate in some crops and soils (Figure 29).

Figure 29. EFFECT OF RECLAIM TREATMENTS ON SOIL DENSITY AS MEASURED BY PUSH METER READINGS

SAND CLAY LOAM IN NORKOTA POTATO TEST PLOTS

Dr. Marvin Mattson. University of Minnesota. Crookston, MN. 1999.

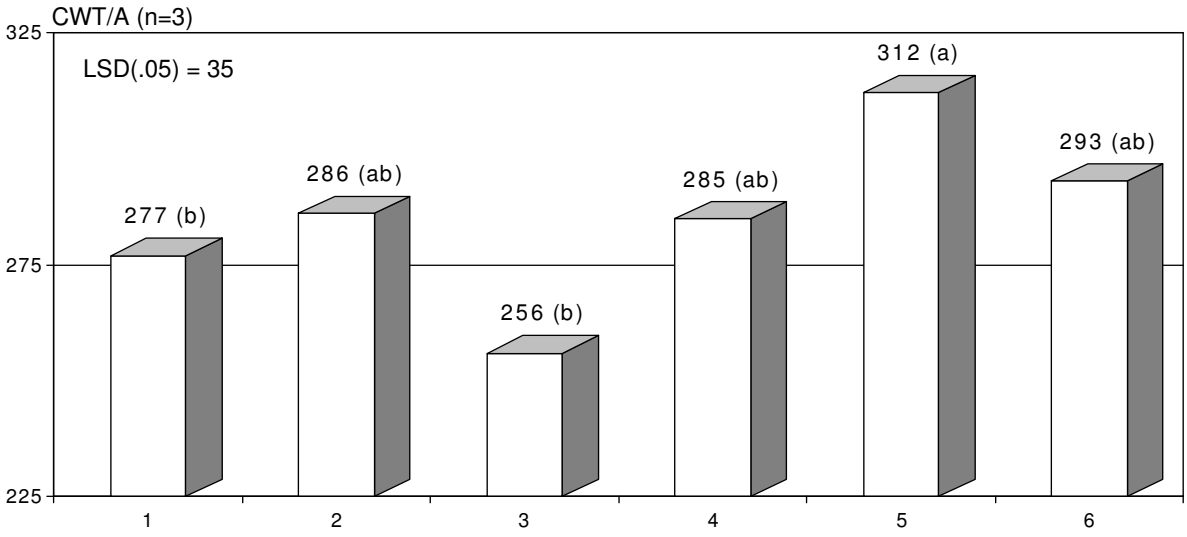


* Reclaim applied May 29 ** Reclaim applied July 12 *** Reclaim applied May 29 and July 12

The highest yield was seen with treatment 5, which included Reclaim @ 32 oz/A BPPI + Renew Plus at 16 oz foliar + Reclaim at 32 oz banded on the soil 42 DAS.

The increase was 3500 lb/A more than the control, a 12% increase. Treatment 3 (Renew Plus alone) was not significantly different than the control and both treatments containing a second application of Reclaim topped the yield list, indicating the necessity of Reclaim in the production program (Figure 30).

Figure 30. EFFECT OF RC98 and RPL98 ON NORKOTA POTATOES
YIELD
Dr. Marvin Mattson. University of Minnesota. Crookston, MN. 1999.



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