Mep Plus – A Newly Registered PGR

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ABSTRACT

MepPlus is a premix of Mepiquat Chloride and Bacillus cereus (BP01). It gained full EPA registration in 1997 for use on cotton. The B. cereus component has a tolerance exemption on all crops. MepPlus was extensively tested by university researchers across the US cotton belt in 1996 and 1997. It provides both significantly higher lint yield and more consistent yield increases than Mepiquat Chloride alone while producing the same degree of earliness and growth control. It was introduced in the US commercially late in the 1997 season. Yield results and preliminary information on the possible mode of action are provided.

Introduction

MepPlus (MP) is a combination of 4.2% Mepiquat Chloride (MC) and two (2) grams of *Bacillus cereus*, BP01. *Bacillus cereus* (BC) is a naturally occurring bacterium patented by Micro Flo as a plant growth regulator. MepPlus was granted full EPA registration in 1977 under that agency's Reduced Risk Initiative that provides expedited review for some microorganisms and other environmentally friendly compounds such as certain natural products. BC-BP01 has a tolerance exemption for all crops in the United States.

Micro Flo Co. initiated testing of combinations of BC and MC on short-staple cotton (*G. hirsutum*) in 1994, with the objective of increasing the consistency of positive yield responses over that seen with commercial formulations of MC alone. Six experimental premixes were compared to an untreated check (UTC) and MC alone in 105 replicated trials over a four-year period, leading to the selection of MepPlus based on superior performance.

Most of the field trials reported here were conducted in 1996 and 1997 but field trials are continuing. Most trials were in randomized complete blocks with four replications on plots of 250-600 square feet (25-60 sq. meters). In 1997, there were also some un-replicated strip trials in paired comparisons (Table 3). Trials were conducted by university and extension researchers and independent crop consultants with a few grower trials. MP was applied at the same rates and timing as MC in all trials.

MP provided several observable or measurable differences versus MC: a) quicker row middle closure (wider canopy) probably related to more and/or heavier bolls on the second and greater fruiting sites on the sympodia and b) more vegetative branch bolls. The consistency of positive yield responses compared to MC alone was significant, while the degree of earliness and control of height growth were the same with both treatments.

The mode of action of the BC component is under investigation.

Results

Yield Comparisons versus UTC – All Plots. Yields were converted to percent increase or decrease from the untreated check (UTC) and the distribution of these values was examined using the chi squared test of independence. The lint yield increases over the untreated control (UTC) were consistently significantly greater (p=.05) with MP but not with MC (Table 1). Across all tests, MP averaged a 10.6% yield increase versus a 3.6% increase for MC, and MP produced a 78.7% positive response over all trials compared to 57.9% for MC. In almost all of the trials in Table 1, four applications of 4 oz. of product/acre were applied at 7-10 day intervals starting at match head square.

Yield Comparisons versus MC – All Plots. Yield comparisons of MC versus MP show that across all trials, MP averaged an 8.5% lint yield increase over MC and provided an 83% positive response rate that was significant at p=.05 (Table 2). The two compounds were applied four times at 4 oz. product/acre starting at match head square at 7-10 day intervals

Yield Results from Paired Comparisons. These trials were conducted in 1997 and generally involved un-replicated strip trials using large plots with two treatments and an UTC. Unlike the trials in the first two tables, the rates and timing used were based on actual grower practice for the MC standard. The number of applications ranged from 1 to 5, at timings from as early as pin head square to as late as the third week of bloom and rates varied from 4 oz/season to 38 oz., mainly in the range of 8-16 oz. (Table 3).

The MP treatment yielded 158 lbs/A more lint than the UTC in the 23 trials where these treatments were compared. This was significant at the p = 0.01 level. MP was also significantly superior to MC, yielding almost 112 lbs. more lint/A in the 63 trials with this comparison, again significant at p = 0.01.

Relative Yield Results (MepPlus vs MC) Based on MC Relative Yield. Based on all relevant trials, the lower the relative yield increase or decreases with MC alone, the bigger the advantage of MepPlus over MC

(Fig. 1). Under conditions where MC alone was ineffective in yield promotion, MP gave superior results. The same trend was seen where absolute yield levels versus response were compared (data not shown). The lower the absolute yield increase with MC, the higher the advantage of MP. Across environments, the superiority of MP performance in consistency over MC was clear.

Earliness. Numerically, MP gave slightly superior earliness to MC, based on % open bolls and/or # of nodes above first position white flower data at cutout date(data not shown).

Height. Differences in height growth control were indistinguishable between MC and MP (data not shown).

Mode of Action. The mode of action of the BC component of MP is being investigated. Field studies have shown lower accumulation of dry weight in leaves and especially stems with MP than with MC at the same rates and timings (Oosterhuis et al, 1998; Wells and Edmisten, 1998). There is increased partitioning to harvestable bolls, giving MP treatments a higher harvest index. The reason for this is yet to be determined.

Summary

MepPlus applied at the same rates and timings as PIX and Mepichlor (MC) provided (a) significantly higher lint yields, (b) significantly greater percent of trials with a positive yield response, and (c) no differences in height growth control or earliness.

References

Oosterhuis, D., D. Zhao and B. Murphy. 1998. In: Proc. Beltwide Cotton Conferences: J. Dugger and D. Richter (Ed). Natl. Cotton Council, Memphis, TN. Pp 1422-1425.

Wells, R. and K. Edmisten. 1998. In: Proc. Beltwide Cotton Conferences: J. Dugger and D. Richter (Ed). Natl. Cotton Council, Memphis, TN. Pp. 1424.

Table 1. Performance of Mepiqut Chloride (MC) and MepPlus(MP) versus UTC – All Plots 1996 and 1997.

Component	Beltwide		MidSouth		Southeast		Southwest	
	MC	MP	MC	MP	MC	MP	MC	MP
% Avg. Yield Increase	3.5	10.6	2.5	11.4	8.2	13.9	1.9	7.3
# of Tests	107	108	51	51	22	22	34	35
% Positive	57.9	78.7	58.8	82.4	68.2	81.8	50.0	71.4
% Negative	42.1	21.3	41.2	17.6	31.8	18.2	50.0	28.6
Significant at .05	ns	Yes	ns	Yes	ns	Yes	ns	Yes

Table 2. Performance of MepPlus versus Mepiquat Chloride – All Tests 1996 and 1997.

	Beltwide	MidSouth	Southeast	Southwest
Avg. Yield Increase	8.5%	10.0%	7.8%	5.6%
# of Tests	141	76	30	35
% Positive	83.0	88.2	83.3	71.4
% Negative	17.0	11.8	16.7	28.6
Significant at .05	Yes	Yes	Yes	Yes

Table 3. Performance of MepPlus versus Mepiquat Chloride – Paired comparisons, grower practice 1997.

Comparisons	# of Pairs	Lint Mean Difference (lbs/A)	t - value	2-tail Significance
MepPlus vs UTC	23	157.9	5.72	<.001
MepPlus vs Pix/Mepichlor	63	111.6	6.10	<.001

Figure 1. Effect of yield response of mepiquat chloride on yield response of MepPlus.