

UW – Madison Weed Science Renz Lab

Will Kudos applied over the top in a corn-alfalfa interseeded system improve alfalfa survival and not limit corn silage yield?

Lead Investigators: Dr. Mark Renz, Dr. John Grabber

Study Directors: José Luiz Carvalho de Souza Dias, Leo Roth, Matt Volenec

Contact: nlroth2@wisc.edu – 236 Moore Hall, 1575 Linden Drive, Madison, WI, 53706

Objective:

Determine corn yield and alfalfa survival with over the top applications of Kudos (prohexadione) when applied to corn stands with and without interseeded alfalfa. Determine whether corn growth stage at Kudos application affected corn yield.

Summary:

Differences in total corn yield were observed between corn interseeded with alfalfa (6.4 – 6.9 tons of dry matter/acre) and corn planted alone (8.5 – 8.8 tons dry matter/acre). However, no differences in corn yield were detected based on timing of Kudos application.

At 1-2, 2-3, and 3-4 weeks after Kudos application, corn heights were lower for corn interseeded with alfalfa than for corn planted alone. Timing of Kudos application resulted in minor corn height differences at 3-4 weeks after application, as C-timing (late) applications of Kudos resulted in corn plants that were 6% shorter than A-timing (early) Kudos applications.

For primary corn ears harvested 8-10 weeks after Kudos application (August 27th), ear lengths were 1-3cm greater for corn planted alone compared to corn interseeded with alfalfa. Number of corn ear rows and corn ear diameter did not vary across Kudos application timings. For secondary corn ears, there were no differences in number of corn rows, length, or diameter.

In interseeded corn-alfalfa plots, alfalfa cover and root crowns per square foot did not differ between application timings of Kudos at the end of the growing season (October 8th).

Results suggest that, while interseeding can impact corn silage yield, Kudos application timing did not influence corn yield or indicators of corn yield. Alfalfa density was also not affected by Kudos timing suggesting that over the top applications hold promise as an application method over directed applications. Research in subsequent years will be required to confirm this result.



Herbicide Treatments				
Trt No.	Cropping System	Treatment	Rate	Application Timing
1	Corn Only	Kudos Priaxor Warrior II	13 ounces of dry weight per acre (oz wt/A) 4 fluid ounces per acre (fl oz/A) 1 fl oz/A	A
2	Corn Only	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	B
3	Corn Only	Kudos Priaxor Warrior II	13 oz wt/A 4 fluid ounces per acre fl oz/A 1 fl oz/A	C
4	Interseeded (Corn + Alfalfa)	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	A
5	Interseeded (Corn + Alfalfa)	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	B
6	Interseeded (Corn + Alfalfa)	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	C

Herbicide Application			
Application Timing	A-Timing	B-Timing	C-Timing
Date	June 15 th , 2020	June 18 th , 2020	June 23 rd , 2020
Equipment	CO ₂ pressurized 10-foot boom sprayer (20 GPA)	CO ₂ pressurized 10-foot boom sprayer (20 GPA)	CO ₂ pressurized 10-foot boom sprayer (20 GPA)
Nozzles & spacing	Eight TeeJet 11002VS XR Nozzles with 15-inch spacing	Eight TeeJet 11002VS XR Nozzles with 15-inch spacing	Eight TeeJet 11002VS XR Nozzles with 15-inch spacing



Weather Data

Weather Station	KWIPOYNE5		
Application Timing	A-Timing	B-Timing	C-Timing
Temperature	68 - 71°F	79 - 82°F	72 - 74°F
Wind Speed	10 mph	5 - 6 mph	7 - 13 mph
Relative Humidity	43%	38 - 44%	50 - 53%
Cloud Cover	20%	5%	40%
Previous Rain Event Within 48 Hours	None	None	June 22 nd , 2020, 11:30pm – 0.48 inches
When ≥ 0.25 inches of precipitation occurred after treatment	June 20 th , 2020, 4pm – 0.61 inches	June 20 th , 2020, 4pm – 0.61 inches	June 26 th , 2020, 5:45pm – 0.35 inches

Research Plot Information

Plot Dimensions	10 feet by 20 feet (200 square feet)
Design	Randomized Complete Block, 4 blocks
Soil Type	Plano silt loam
Soil Characteristics	22.5% clay, 4% organic matter, 6.7 pH, 1% slope

Agronomic Notes

- **Corn Information:**
 - variety: Agrigold A636-56 STXRIB (106 day)
 - planting rate: 33,500 seeds/acre
 - planting date: May 11th, 2020
 - fertilized with 50-20-20 starter

Plants Present at Application – Developmental Stage

A - Timing		
Species	Average Height (in)	Phenological Stage
Alfalfa	6	-
Corn	16	V5
B - Timing		
Alfalfa	8	-
Corn	17	V5-V6
C - Timing		
Alfalfa	12	-
Corn	30	V6-V7

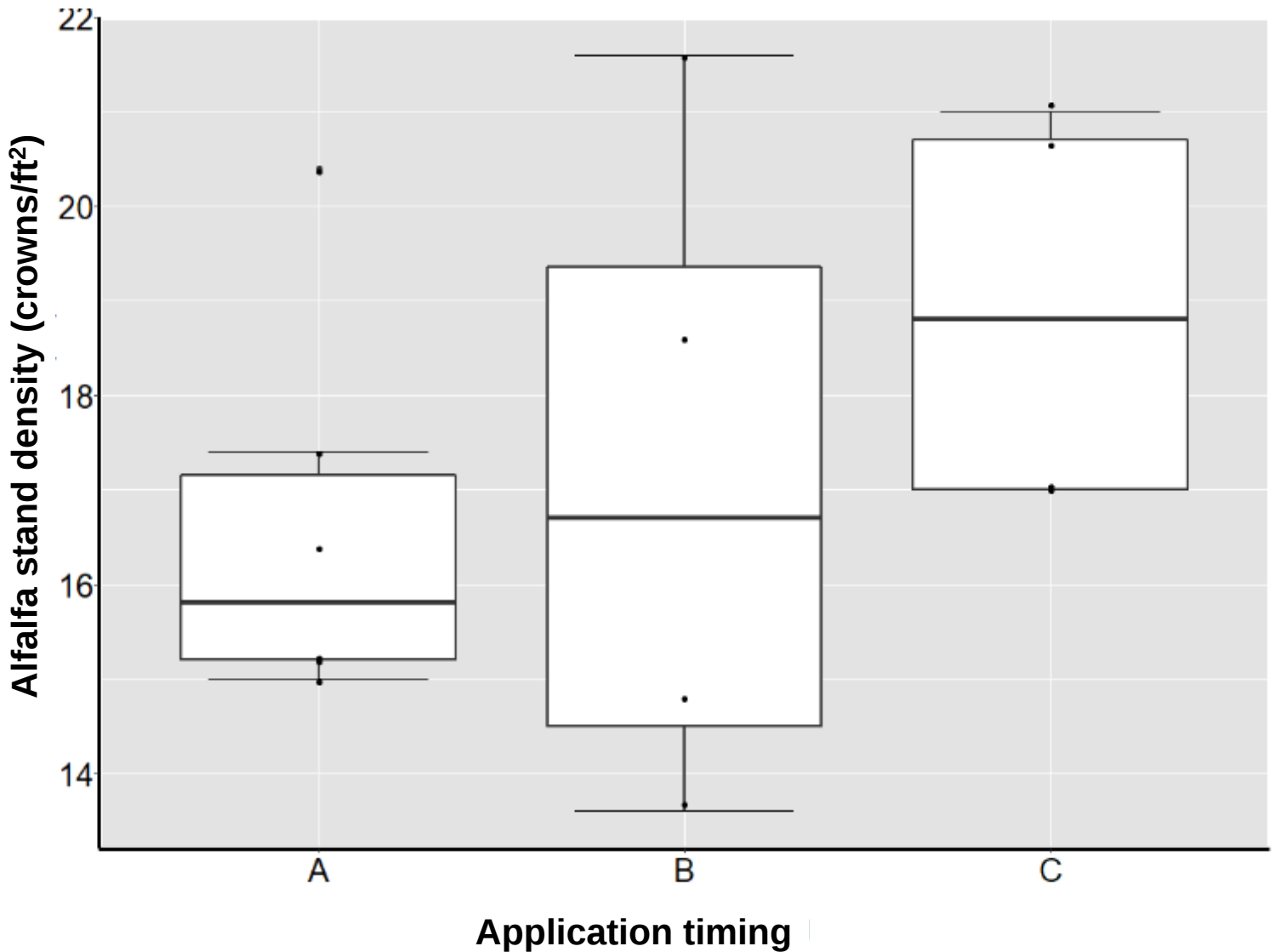
Index of Ratings and Results

Alfalfa Stand Density – End of Growing Season	5
15 Days after A-Application, 8 Days after C-Application – June 30 th , 2020.....	6
23 Days after A-Application, 15 Days after C-Application – July 8 th , 2020	7
32 Days after A-Application, 24 Days after C-Application – July 17 th , 2020	8
56 Days after A-Application, 48 Days after C-Application – August 10 th , 2020.....	9
73 Days after A-Application, 65 Days after C-Application – August 27 th , 2020.....	10
81 Days after A-Application, 73 Days after C-Application – September 4 th , 2020	11
115 Days after A-Application, 107 Days after C-Application – October 8 th , 2020	12
Corn Yield Data – Tons per Acre at Harvest	13
95 Days after A-Application, 87 Days after C-Application – September 18 th , 2020	13
Corn Yield Data – Primary Corn Ear	14
73 Days after A-Application, 65 Days after C-Application – August 27 th , 2020.....	14
Corn Yield Data – Secondary Corn Ear	15
81 Days after A-Application, 73 Days after C-Application – September 4 th , 2020	15



Results:

Alfalfa Stand Density – End of Growing Season



```
Response: y_sqrt
          Df Sum Sq Mean Sq F value Pr(>F)
Rep        3  0.39196   0.130655   1.6164  0.2607
Timing     2  0.20854   0.104268   1.2899  0.3269
Residuals  8  0.64665   0.080832
```

No significant timing effect on alfalfa stand density. Note that data were square root transformed to correct for assumptions of ANOVA.



15 Days after A-Application, 8 Days after C-Application – June 30th, 2020

Trt No.	Cropping System	Treatment	Rate	Timing	Corn Height (cm)	Alfalfa Height (cm)
1	Corn Only	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	A	110 a	-
2	Corn Only	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	B	100 bc	-
3	Corn Only	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	C	110 a	-
4	Interseeded (Corn + Alfalfa)	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	A	96 c	29 b
5	Interseeded (Corn + Alfalfa)	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	B	101 bc	30 b
6	Interseeded (Corn + Alfalfa)	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	C	106 ab	32 a
Statistics¹						
Least Significant Difference (LSD) P=.05					6.83	2.14
Standard Deviation					4.47	1.24
Coefficient of Variation (CV)					4.32	4.06
Treatment Prob(F)					0.0054	0.0142

Note: Means followed by same letter or symbol do not significantly differ (P=.05, LSD).

¹ All subsequent statistical analyses were conducted in ARM software and assumptions of ANOVA were not evaluated.



23 Days after A-Application, 15 Days after C-Application – July 8th, 2020

Trt No.	Cropping System	Treatment	Rate	Timing	Corn Height (cm)	Alfalfa Height (cm)
1	Corn Only	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	A	186 a	-
2	Corn Only	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	B	174 bc	-
3	Corn Only	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	C	180 ab	-
4	Interseeded (Corn + Alfalfa)	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	A	167 cd	46 a
5	Interseeded (Corn + Alfalfa)	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	B	166 d	43 ab
6	Interseeded (Corn + Alfalfa)	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	C	158 d	40 b
Statistics						
LSD P=.05					8.45	3.86
Standard Deviation					5.53	2.23
CV					3.24	5.19
Treatment Prob(F)					0.0003	0.0398

Note: Means followed by same letter or symbol do not significantly differ (P=.05, LSD).



32 Days after A-Application, 24 Days after C-Application – July 17th, 2020

Trt No.	Cropping System	Treatment	Rate	Timing	Corn Height (cm)	Corn Stalk Circumference (mm)	Alfalfa Height (cm)	Alfalfa Injury (%)
1	Corn Only	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	A	250 a	73 a	-	-
2	Corn Only	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	B	243 ab	74 a	-	-
3	Corn Only	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	C	234 bc	74 a	-	-
4	Interseeded (Corn + Alfalfa)	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	A	224 cd	67 b	47 -	0 b
5	Interseeded (Corn + Alfalfa)	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	B	218 d	68 b	44 -	5 a
6	Interseeded (Corn + Alfalfa)	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	C	212 d	68 b	42 -	1 b
Statistics								
LSD P=.05					12.34	3.897	3.77	2.5
Standard Deviation					8.08	2.551	2.18	1.44
CV					3.54	3.6	4.87	69.28
Treatment Prob(F)					0.0003	0.0037	0.0557	0.0066



56 Days after A-Application, 48 Days after C-Application – August 10th, 2020

Trt No.	Cropping System	Treatment	Rate	Timing	Alfalfa Defoliation (%)	Alfalfa Cover (%)
1	Corn Only	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	A	-	-
2	Corn Only	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	B	-	-
3	Corn Only	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	C	-	-
4	Interseeded (Corn + Alfalfa)	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	A	5 -	82 -
5	Interseeded (Corn + Alfalfa)	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	B	5 -	86 -
6	Interseeded (Corn + Alfalfa)	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	C	4 -	82 -
Statistics						
LSD P=.05					4.84	10.45
Standard Deviation					2.8	6.04
CV					58.33	7.22
Treatment Prob(F)					0.6481	0.5033



73 Days after A-Application, 65 Days after C-Application – August 27th, 2020

Trt No.	Cropping System	Treatment	Rate	Timing	Primary Corn Ear Height (cm)	Corn Stalk Diameter (mm)
1	Corn Only	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	A	121 -	22 a
2	Corn Only	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	B	118 -	22 a
3	Corn Only	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	C	112 -	22 a
4	Interseeded (Corn + Alfalfa)	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	A	112 -	20 b
5	Interseeded (Corn + Alfalfa)	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	B	112 -	20 b
6	Interseeded (Corn + Alfalfa)	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	C	102 -	21 ab
Statistics						
LSD P=.05					13.15	1.56
Standard Deviation					8.61	1.02
CV					7.66	4.83
Treatment Prob(F)					0.1287	0.0206



81 Days after A-Application, 73 Days after C-Application – September 4th, 2020

Trt No.	Cropping System	Treatment	Rate	Timing	Alfalfa Cover (%)	Annual Broadleaf Weed Cover (%)	Perennial Broadleaf Weed Cover (%)	Grass Weed Cover (%)	Bareground /Litter (%)
1	Corn Only	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	A	-	0 -	0 -	0.5 -	99.5 a
2	Corn Only	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	B	-	0 -	0 -	2 -	98 a
3	Corn Only	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	C	-	0 -	0.3 -	2 -	98 a
4	Interseeded (Corn + Alfalfa)	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	A	10 -	0.5 -	0.3 -	2 -	86 b
5	Interseeded (Corn + Alfalfa)	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	B	15 -	0.3 -	0.3 -	2 -	82 b
6	Interseeded (Corn + Alfalfa)	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	C	13 -	0 -	0 -	6 -	80 b
Statistics									
LSD P=.05					9.38	0.43	0.4	5.73	7.62
Standard Deviation					5.42	0.28	0.26	3.75	4.99
CV					42.5	205.08	192.95	147.36	5.53
Treatment Prob(F)					0.502	0.1235	0.4633	0.4384	0.0003

115 Days after A-Application, 107 Days after C-Application – October 8th, 2020

Trt No.	Cropping System	Treatment	Rate	Timing	Alfalfa Crown Count (#/ft ²)	Alfalfa Cover (%)
1	Corn Only	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	A	-	-
2	Corn Only	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	B	-	-
3	Corn Only	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	C	-	-
4	Interseeded (Corn + Alfalfa)	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	A	16.5 -	26 -
5	Interseeded (Corn + Alfalfa)	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	B	17.1 -	25 -
6	Interseeded (Corn + Alfalfa)	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	C	18.9 -	26 -
Statistics						
LSD P=.05					4.047	6.91
Standard Deviation					2.339	4
CV					13.35	15.47
Treatment Prob(F)					0.3842	0.8801



Corn Yield Data – Tons per Acre at Harvest

95 Days after A-Application, 87 Days after C-Application – September 18th, 2020

Trt No.	Cropping System	Treatment	Rate	Timing	Tons of Dry Matter/Acre
1	Corn Only	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	A	8.86 a
2	Corn Only	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	B	8.76 a
3	Corn Only	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	C	8.52 a
4	Interseeded (Corn + Alfalfa)	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	A	6.92 b
5	Interseeded (Corn + Alfalfa)	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	B	6.39 b
6	Interseeded (Corn + Alfalfa)	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	C	6.50 b
Statistics					
LSD P=.05					0.8132
Standard Deviation					0.5323
CV					7.05
Treatment Prob(F)					0.0001



Corn Yield Data – Primary Corn Ear

73 Days after A-Application, 65 Days after C-Application – August 27th, 2020

Trt No.	Cropping System	Treatment	Rate	Timing	Ear Rows (#)	Ear Length (cm)	Ear Diameter (cm)
1	Corn Only	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	A	16 -	19 ab	4.6 -
2	Corn Only	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	B	16 -	20 a	4.6 -
3	Corn Only	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	C	16 -	20 a	4.7 -
4	Interseeded (Corn + Alfalfa)	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	A	16 -	18 cd	4.2 -
5	Interseeded (Corn + Alfalfa)	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	B	16 -	19 bc	4.4 -
6	Interseeded (Corn + Alfalfa)	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	C	16 -	17 d	5.6 -
Statistics							
LSD P=.05					0.92	1.247	1.828
Standard Deviation					0.6	0.816	1.197
CV					3.71	4.26	25.27
Treatment Prob(F)					0.1665	0.0008	0.6575



Corn Yield Data – Secondary Corn Ear

81 Days after A-Application, 73 Days after C-Application – September 4th, 2020

Trt No.	Cropping System	Treatment	Rate	Timing	Ear Rows (#)	Ear Length (cm)	Ear Diameter (cm)
1	Corn Only	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	A	14 -	12 -	3.8 -
2	Corn Only	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	B	15 -	19 -	4.4 -
3	Corn Only	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	C	15 -	18 -	4.4 -
4	Interseeded (Corn + Alfalfa)	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	A	14 -	17 -	4.2 -
5	Interseeded (Corn + Alfalfa)	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	B	16 -	16 -	4.2 -
6	Interseeded (Corn + Alfalfa)	Kudos Priaxor Warrior II	13 oz wt/A 4 fl oz/A 1 fl oz/A	C	15 -	14 -	6.9 -
Statistics							
LSD P=.05					1.71	4.949	4.085
Standard Deviation					1.11	3.212	2.652
CV					7.33	19.45	55.63
Treatment Prob(F)					0.8168	0.1002	0.6499