CENTER PIVOT PRECISION MOBILE DRIP IRRIGATION

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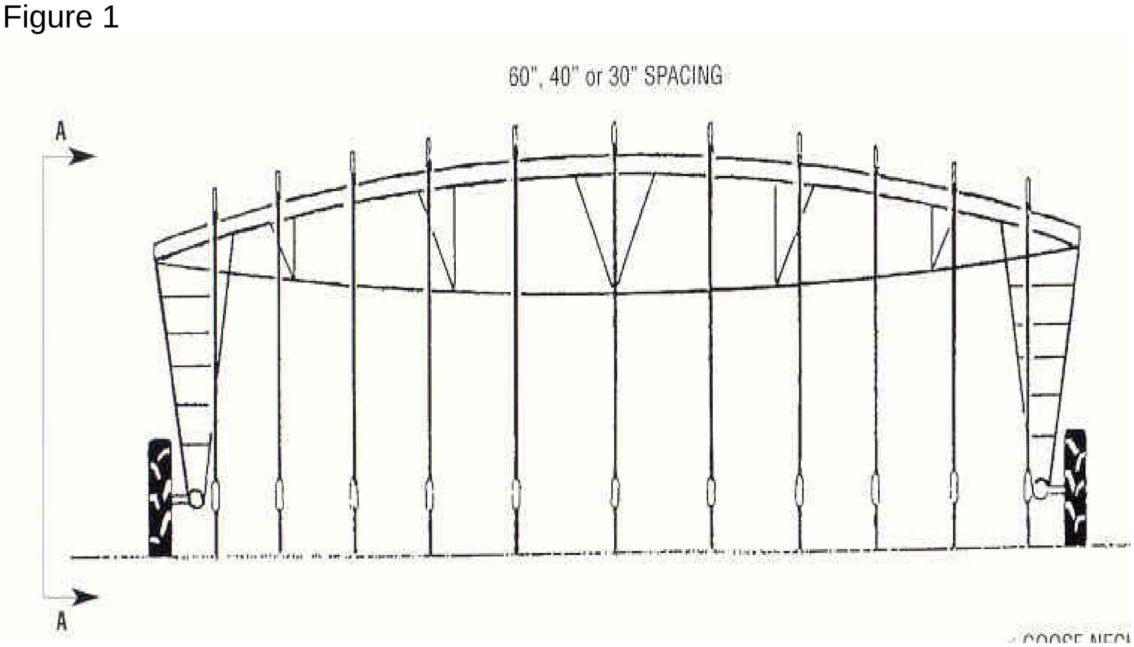
INTRODUCTION

Precision mobile drip irrigation is an irrigation system where drip hoses are attached to a center pivot sprinkler and drug on top of the ground. The placement of water by the hoses on the ground could potentially increase irrigation efficiency over a standard drop nozzle system. In addition, problems associated with wet wheel tracks should be reduced. However, drag hoses lying on the ground could cause more management concerns for farmers. One example would be animal damage to the drip hoses which disrupts uniform water distribution. The objectives of this study were to compare yield from corn irrigated using precision mobile drip irrigation (PMDI) to sprinkler irrigation with drops (drop nozzle). The second objective was to discern if the emitters have a reduction in water flow over the season due to clogging. Figure 1 is a sprinkler with the drag hoses attached.

Figure 1



PROCEDURE

The study was initiated on a center pivot sprinkler located seven miles north and three miles west of Hoxie, KS. Cooperation from DLS Farms was very important to evaluating these two application methods. Three spans, spans 4, 5, and 7, of an eight span center pivot sprinkler were divided into two sections. Each section had either the PMDI system installed or the standard drop nozzle system. With this configuration, three replications of each method were achieved for a total of six plots. The center pivot sprinkler is nozzled to apply 300 gpm. Drag hose spacing on the PMDI system was 60 inches while the spacing on the drop nozzle system was 120 inches. The entire flow to the center pivot was screen filtered to 50 mesh.

For the 2004 growing season, the farmer strip-tilled the field the previous fall and applied 75 lbs/A of N as anhydrous ammonia and 7-25-0 lbs/A as 10-34-0. The field was planted on May 2, 2004 in circular rows with Mycogen 2E685 treated with Cruiser at 26,000 seeds/A with 50 lbs/A of N as 32% UAN applied in a 2x2. Appropriate pest management measures were taken to control weeds and insects.

For the 2005 growing season, manure was applied to the field, and then the field was strip-tilled in the fall. On April 28, 2005 Mycogen 2E762 treated with Cruiser was seeded in straight noncircular rows at 26,000 seeds/A with 50 lbs/A of N as 32% UAN applied in a 2x2. Appropriate pest management measures were taken to control weeds and insects.

Emitter water flow at the end emitter and then the 5, 10, and 15 emitter from the end of two drag hoses from each plot were captured for one minute on May 26, August 4, and September 13 in 2004 and May 27, July 29, and September 8 in 2005. Water flow for the entire drag hose was also collected for the two drag hoses along with the water flow from two drop nozzles on the same span.

Corn yield was collected in two ways. First, samples were hand harvested from forty feet of each plot. Samples were then dried, threshed, weighed, and yield was calculated on a bu/a basis. Yield was also collected at harvesting using a Green Star yield monitoring system for the entire field.

RESULTS

Weather conditions over the summer brought supplemental rainfall which allowed for respectable yields to be achieved at the site for both years. When comparing hand harvest yields, there was no significant difference between the PMDI treatment and the drop nozzle treatment in either year or when combined across years (Table 1). When looking at the 2004 field map (Fig. 2) or the 2005 field map (Fig. 3) generated by a yield monitor, no discernable pattern was evident between the two systems.

Table 1. Yield (bu/a) as influenced by irrigation treatment (Data from hand harvest)

Treatment	2004	2005	Combined Results
PMDI	233	239	236
Drop Nozzle	236	236	236
LSD (0.05)	NS	NS	NS

Fig. 2 – 2004 Field Map

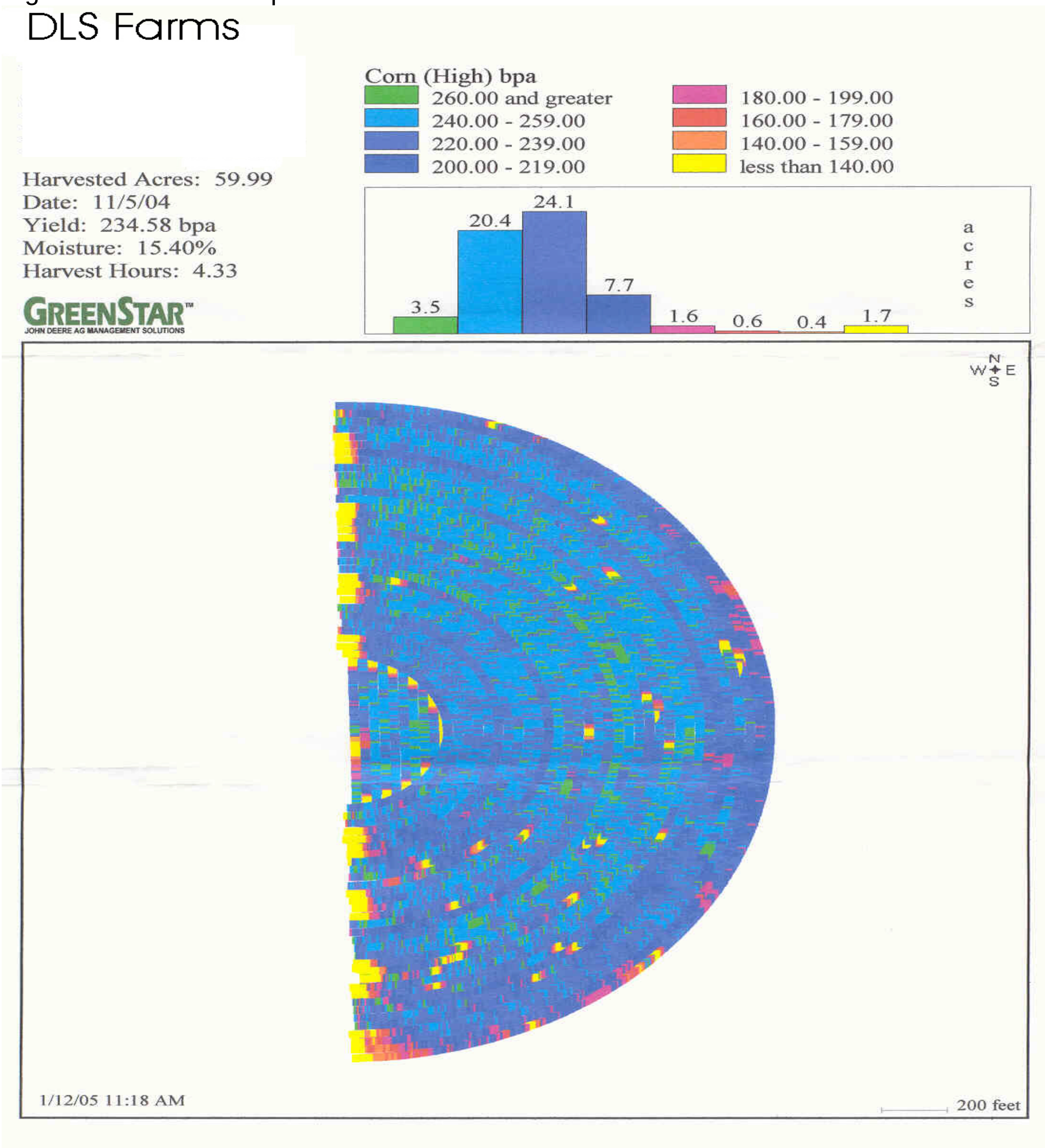
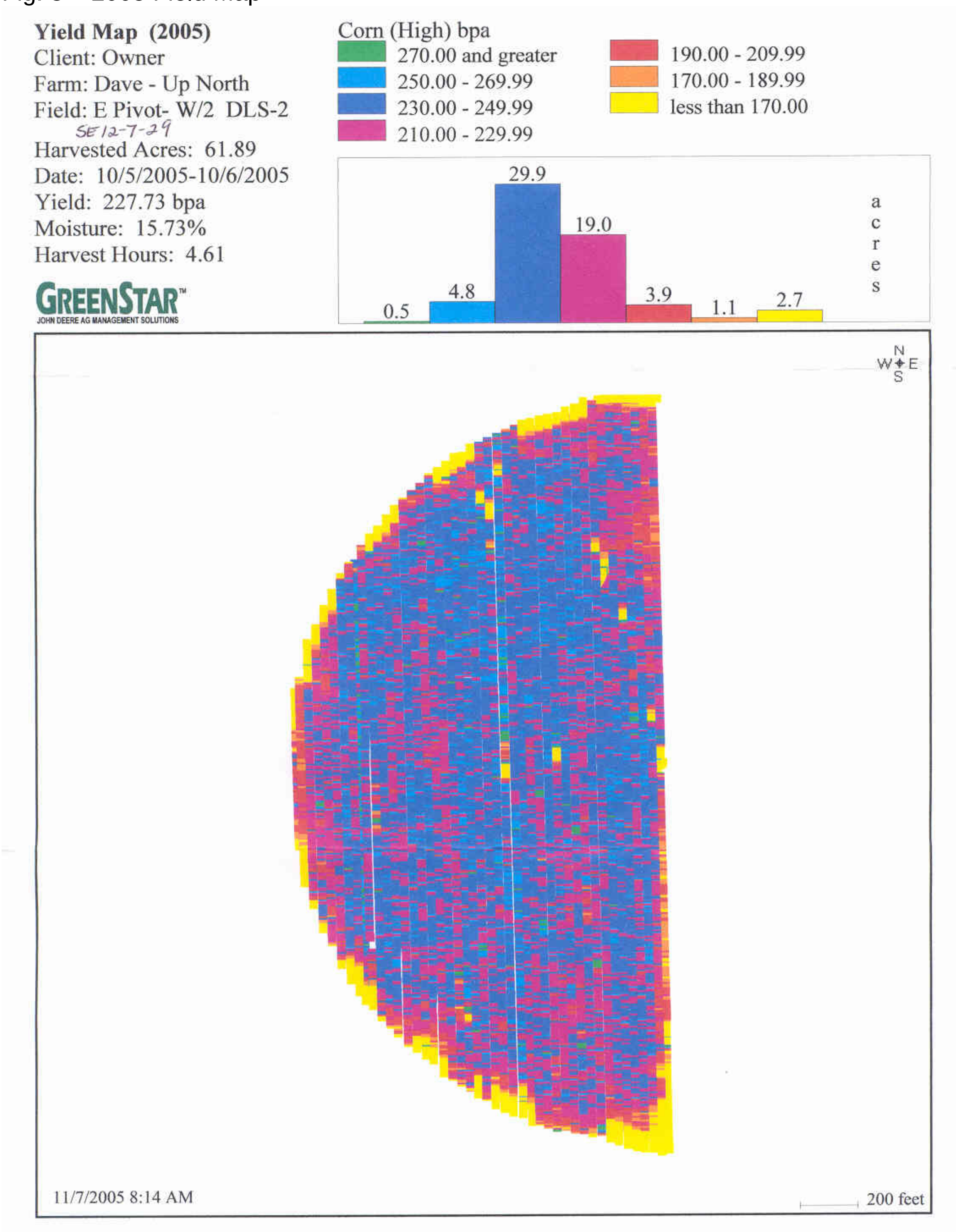


Fig. 3 – 2005 Field Map



In 2004, the average emitter output over the summer declined from 214 ml/min. on May 24 to 209 ml/min on August 4 to 180 ml/min on September 13. Output from the emitters decreased by an average of 16% through the summer (Fig. 5). Output from the nozzles from span 4, 5, and 7 also decreased from an average of 2.51 gpm on May 26 to 2.48 gpm on August 4 to 2.28 gpm on September 13 (Fig. 4). The average reduction in flow was 9%. The 9% reduction in flow indicates that the overall pumping capacity of the well was reduced. However, the additional 7% reduction in flow rate from the emitters is likely due to emitter clogging.

In 2005, the average emitter output over the summer declined from 180 ml/min. on May 27 to 168 ml/min on July 29 to 158 ml/min on September 8. Output from the emitters decreased by an average of 14% through the summer (Fig. 5). Output from the nozzles from span 4, 5, and 7 actually increased from an average of 2.13 gpm on May 27 to 2.17 gpm on July 29 to 2.49 gpm on September 8. The average increase in flow was 17%. Why there was an increase in flow over this time is difficult to explain, but it may be related to a difference in field evaluation for the locations where the sampling was conducted. However, there was a greater difference in 2005 compared with 2004 in the flow between the average output of the emitters and the average output of the nozzles which implies increased clogging of the emitters.

Summary

In conclusion, as with any field evaluation, variability is inherently higher due to factors outside of the parameters that can be controlled by the investigators. However, there was no positive or negative impact on yield from those plots that were irrigated with the PMDI system versus a standard drop nozzle system. Emitter flow was decreased in both years when compared with nozzle flow which was likely due to emitter clogging. Clogging of the emitters over the life of the system along with puncturing of the hoses from wildlife appear to be two negatives of the system, while one benefit of the system was the reduced wheel pivot tracks when the PMDI system is used to water crops near the pivot wheel. The authors of this paper would again like to thank DLS farms for their cooperation on this project.

Fig. 5. Emitter response from 2004 and 2005

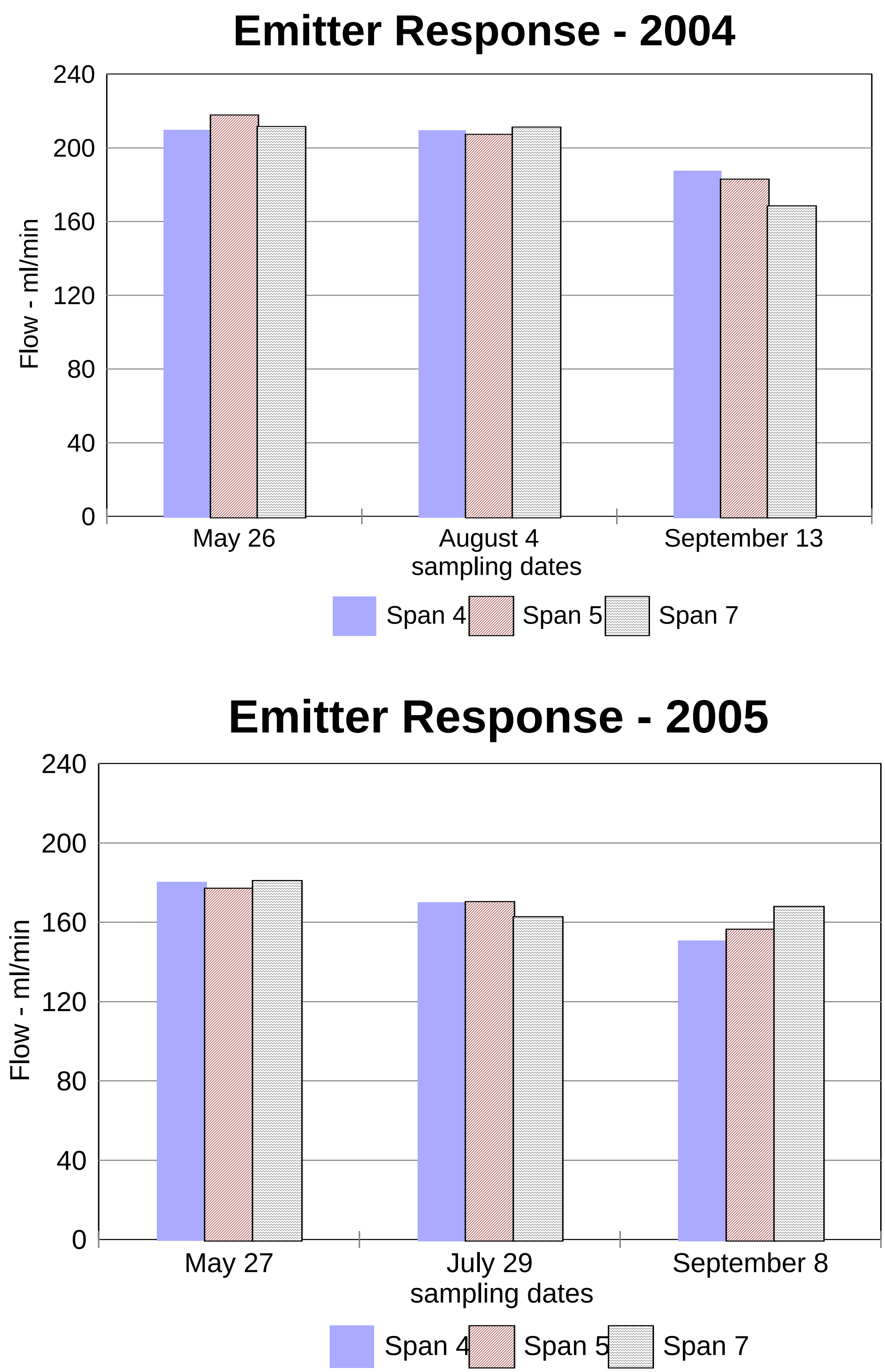


Fig. 6. Nozzle Response from 2004 and 2005