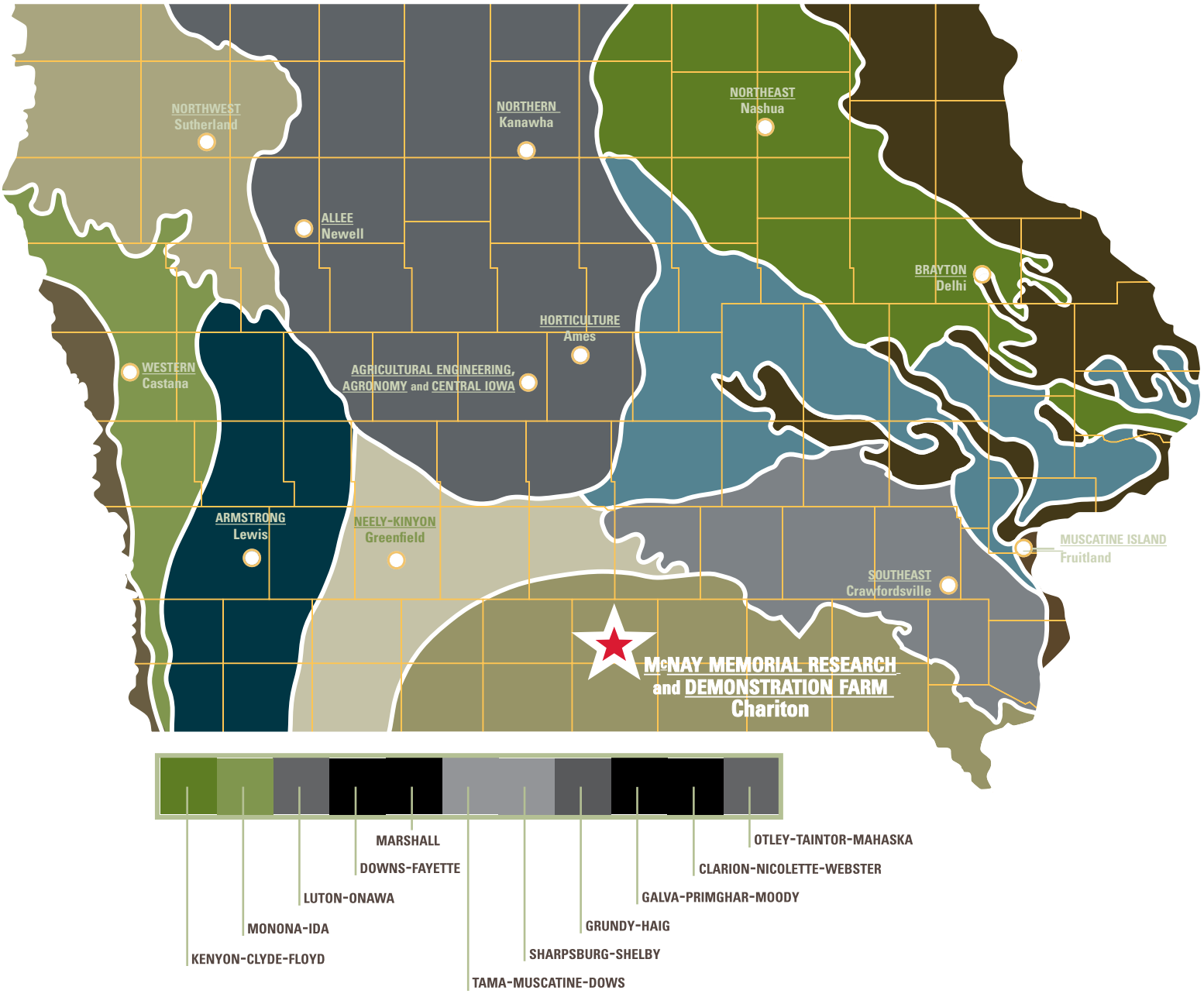
IOWA STATE UNIVERSITY
College of Agriculture and Life Sciences

Research and Demonstration Farms

McNay Memorial Research and Demonstration Farm

2022 SUMMARY



ISRF22M April 2023

Research and Demonstraton Farms

In 1858, the Iowa Legislature chartered the Iowa Agricultural College and Model Farm. Today, the College of Agriculture and Life Sciences at Iowa State University is one of the world's leading institutions of agriculture, providing leadership in science, education, and extension.

The McNay Farm had its beginning in 1956 when Harry McNay and his sister, Winnie, deeded their 480-acre farm for use as a research facility. From 1956 to the mid-1970s the primary area of research was beef cattle breeding and management. Studies on pasture management, beef cattle disease, tillage practices, hay storage, weeds, soil, insects, early weaning, timber management, and beef cattle systems management have been added.

Since 1967, the acreage at the McNay Memorial Research and Demonstration Farm Farm has been increased to 1,972 acres to accommodate the research needs in southern Iowa. In 2004, the purebred Angus beef cow herd was relocated to the McNay Farm when the operations at the Iowa State University Rhodes Farm were discontinued. In 2019, the Tharp family donated 262 acres, a mix of pasture and cropland, to Iowa State. The tracts are located northeast of the McNay farm and are operated as part of the McNay farm.

In 2019, the Tharp family donated 262 acres. The new total acreage of the McNay research farm is 2,229 acres.

IOWA STATE UNIVERSITY
Extension and Outreach

College of Agriculture and Life Sciences
Agriculture and Home Economics Experiment Station
Iowa State University Extension and Outreach

Staff

Logan Wallace—manager, crops and operations

Brad Evans—manager, livestock

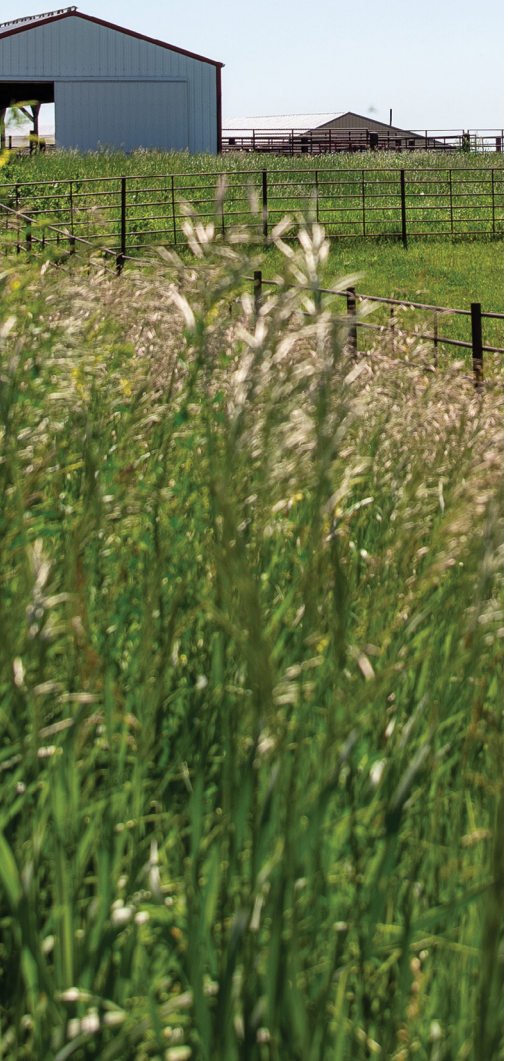
Gary Thompson—agricultural specialist

Chase Altenhofen—agricultural specialist

Charles Phillips—agricultural specialist

McNay Memorial Research and Demonstration Farm

Table of Contents



Farm and Weather Summary

Logan Wallace, farm co-manager

Brad Evans, farm co-manager

Farm Comments

Developments. The McNay research farm focuses on beef cattle, forage, and crop research in south-central Iowa. The work continues to expand and is well received. Many soil conservation, cattle water system, and fence improvements were made last year. A pasture improvement project was started five years ago and will continue over the next several years.

Field days and tours. Six events were held with 480 people attending field days and meetings. There also were 45 vistors with other groups at the farm.

Livestock. In 2022, the purebred Angus herd produced 257 calves in the spring and 102 calves in the fall.

Crop Season Comments

The 2022 crop season got off to a good start. Planting was accomplished on time. Summer turned dry and affected both hay and row crops. A good rain or two in late July or August would have been helpful. A dry summer led to a dry fall. Silage was harvested and researchers planted wheat following as an experiment to see how it does in Iowa. Row crops were harvested without any trouble although yields were a little lighter than normal. Corn averaged 160 bushels per acre and beans yielded 50 bushels per acre. Fall tillage was completed and the farm is resting for the winter.

Weather Comments

Winter. Winter was an average southern Iowa winter. Cattle stayed in above-average condition.

Spring. April was cooler than average, which led to a slow green-up of pastures. Crops were planted timely. May and June were wet and slowed down some plant growth, but replenished needed moisture for pastures.

Summer. Summer was dry in July and August with late hay cuttings that were less than average. Crops progressed well through the summer months, even with the lack of moisture.

Fall. Fall was mild with below average precipataion, allowing harvest to be completed on time. The lack of late summer moisture led to less grazing days later in fall.

The growing season of March through October had 23.48 in. of precipitation, compared with an average of 29.51 in. For the year, precipitation was below average at 5.97 in. below the long-term average (Table 1). Dry weather in August reduced yield potential for soybean.

Table 1. Monthly rainfall and average temperatures.

Month	Rainfall, inches	Departure from normal	Temperature °F	Departure from normal	Days +90°F
March	3.70	1.65	38	0.60	0
April	3.21	-0.18	46	-3.49	0
May	3.47	-0.93	63	2.19	0
June	3.84	-1.08	74	3.45	6
July	2.01	-2.08	75	0.28	9
August	1.76	-2.17	75	1.72	7
September	4.07	0.03	67	2.01	3
October	1.42	-1.24	53	-0.68	0
Total	23.48	-6.00			25

Research Projects

Project	Project Lead
Long-term N fertilizer	M. Castellano
Annual forage plots	C. Clark
Beef cattle breeding project	vacant
Beef calf anaplasmosis transmission	M. Hindman/ L. Geoffroy
Beef calf colostrum survey	
Crownrot plots	E. Hodgson
Insect traps	
Conventional soybean variety trial	A. Singh
Corn interseeding covercrop	M. Licht
Long-term tillage	
Fungicide/insecticide	D. Mueller
Corn rootworm	A. Robertson
On farm–soybean population	M. Witt
Soybean date of planting, maturity, fungicide	M. Witt/Iowa Soybean Association
STRIPS study	T. Youngquist

Water Quality Evaluation of Integrating Strips of Native Prairie Into Rowcrop Agriculture Fields

Chris Witte—assistant scientist, agricultural and biosystems engineering

Matt Helmers—professor, agricultural and biosystems engineering

Lisa Schulte-Moore—professor, natural resource ecology and management

Matt Liebman—professor, agronomy

Tim Youngquist—agricultural specialist II, agronomy

Tallgrass prairie once covered more than 85% of the total land area of the state of Iowa. Currently, less than .01% of that original ground cover remains. The remnant prairies largely exist in small blocks along railroad right-of-ways, cemetery edges, and other marginal locations. Prairie is a diverse ecosystem consisting of grasses, legumes, sedges, and non-legume forbs. In addition to the plant communities, prairie provides habitat for a wide range of native birds, mammals, and beneficial insects. STRIPS (Science-based Trials of Rowcrops Integrated with Prairie Strips) seeks to integrate conservation and rowcrop production and to use science to understand the effects prairie has on the surrounding cropland. The objectives of this study were to evaluate the water quality benefits provided by prairie strips.

Materials and Methods

The experiment was set up at the Iowa State University McNay farm, Chariton, Iowa, as a paired comparison trial in November 2015. A treatment field was selected as a location for the prairie strips. A control field, with similar land characteristics, same crop, and same management conditions also was chosen (Figure 1). The proliferation of species in a native prairie includes in the hundreds of species. Due to availability, cost, and practicality, this experiment seeks to mimic the natural system, rather than recreate it. A mix of 45 native prairie species were seeded. A seed drill was used to directly seed the native species into the field stubble on June 18, 2014.

A nurse crop of winter rye was seeded with the prairie species to provide faster, more substantial growth in the strips and reduce competition from noxious weeds. The seed drilling was hired and operated by a local prairie seed dealer. Following the seeding, instrumentation to measure surface runoff was installed in 2016 with monitoring beginning in 2017. The largest piece of equipment on site is the Hydrologic flume (H-flume). The H-flume was installed at the base of the watershed where flow of water is concentrated, and therefore, more easily measured and collected for nutrient and sediment analyses via autosampler (Figure 2). Collected water samples are analyzed for concentrations of total suspended solids, total nitrogen, total phosphorus, nitrates/nitrites, and orthophosphorus. Based on the size of the monitored drainage area, the exported load of each analyte is estimated.

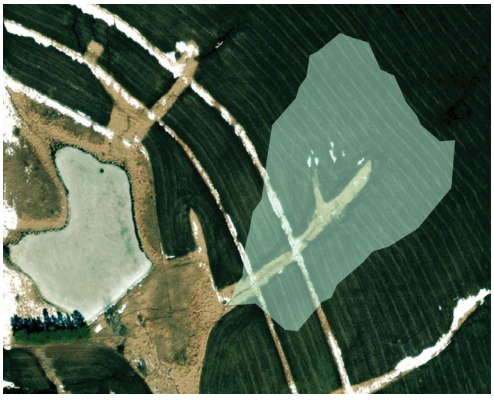


Figure 1: Monitored prairie strips site at the McNay research farm. The green highlighted area shows the contributing watershed being monitored for runoff.

Figure 2: Flume structure for monitoring runoff.

Results and Discussion

Rain and surface runoff. For the last six years, rainfall during the monitoring season (approximately beginning of April to end of October) has ranged from 9.9 to 39.8 in. (Table 1). Much of this rainfall, however, has not been intense enough to cause runoff from the monitored fields. Surface runoff from the control field has ranged from 0.02 to 2.78 in., while the treatment field has ranged from 0.34 to 4.8 in. There have been some issues with monitoring the control watershed (monitored field without prairie strips), as runoff was being diverted out of the grassed waterway, thus bypassing the monitoring equipment. Therefore, runoff estimates are less than what really occurred at this field. This issue was addressed during the 2021 season, and researchers believe the waterway is functioning properly now. Also, the treatment watershed does have a side-slope seep, which likely has contributed to an inflated estimate of runoff from this field.

Nutrient and sediment export. Due to the missed measured surface water runoff, the estimates of exported nutrients and total suspended solids from the control watershed also are low (Table 1). Therefore, confidence in these numbers from the control watershed are low, but are being listed for the sake of the report. Note that starting in 2021 the runoff has been greater in the control than the treatment watershed. Researchers believe this is the result of having repaired the control waterway. In addition, 2022 was the first complete monitoring season with the repaired waterway, when greater nutrient and sediment exports in the control watershed were recorded than in the treatment. This is what might be expected if prairie strips were affecting surface runoff water quality.

Acknowledgements

These sources should be acknowledged for helping to establish and maintain the experiment: USDA Farm Service Agency (AG-3151-P-14-0162), Iowa Department of Agriculture and Land Stewardship Division of Soil Conservation, Iowa Nutrient Research Center, and the US Forest Service Northern Research Station.

Table 1: End of monitoring season totals for rain and surface runoff (inches), as well as nutrient and sediment export (pounds/acre) from the field with (treatment) and without (control) prairie strips.

Year	Rain, inches	Control	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control	Treatment
2017	13.3	1.18	1.77	2.20	5.31	3.18	5.55	0.14	0.05	0.41	0.18	192.33	66.26
2018	23.1	2.65	4.80	0.07	0.26	0.46	1.06	0.13	0.13	0.22	0.35	41.60	103.43
2019	22.0	0.72	4.15	0.80	3.03	1.40	4.28	0.10	0.28	0.24	0.62	122.92	304.78
2020	12.7	0.02	2.05	0.00	0.15	0.00	0.70	0.00	0.05	0.00	0.17	0.38	109.11
2021	39.8	2.78	2.07	0.92	1.00	1.36	1.54	0.13	0.06	0.18	0.09	19.72	24.15
2022	9.9	1.96	0.34	0.02	0.01	0.49	0.20	0.02	0.01	0.09	0.03	29.68	14.38

Long-Term Tillage and Crop Rotation Trial

Mark Licht—associate professor, agronomy

Fernando Marcos—research scientist, agronomy

Objective

Evaluate the long-term effects of tillage systems and crop rotations on grain yields.

Materials and Methods

Site-Year 1: Chariton | Crop Year–2021

Soil type	Haig, Grundy
Previous crop	Corn and soybean
Hybrid/variety	Pioneer 1366AM
Planting date	April 23, 2021
Row spacing	30-in.
Seeding rate	32,000
Tillage	NT, ST, DR, CP, MP–early November 2020; spring cultivator in April 2021
Fertilizer	22-104-124
Nitrogen	200 lb. N as 32%
Harvest date	September 23, 2021
Experimental design	Randomized complete block design
Replications	Four
Treatments	No-tillage (NT), strip-tillage (ST), chisel plow (CP), deep rip (DR), moldboard plow (MP)

Site-Year 2: Chariton | Crop Year–2022

Soil type	Haig, Grundy
Previous crop	Corn
Hybrid/variety	Corn–Pioneer 1366AM, soybean–QP35T15E
Planting date	May 17, 2022
Row spacing	30-in.
Seeding rate	Corn–32,000, Soybean–140,000
Tillage	NT, ST, DR, CP, MP–early November 2020; spring cultivator in April 2021
Fertilizer	22-104-0 25S
Nitrogen	200 lb. N as 32%
Harvest date	October 18, 2022
Experimental design	Randomized complete block design
Replications	Four
Treatments	No-tillage (NT), strip-tillage (ST), chisel plow (CP), deep rip (DR), moldboard plow (MP)

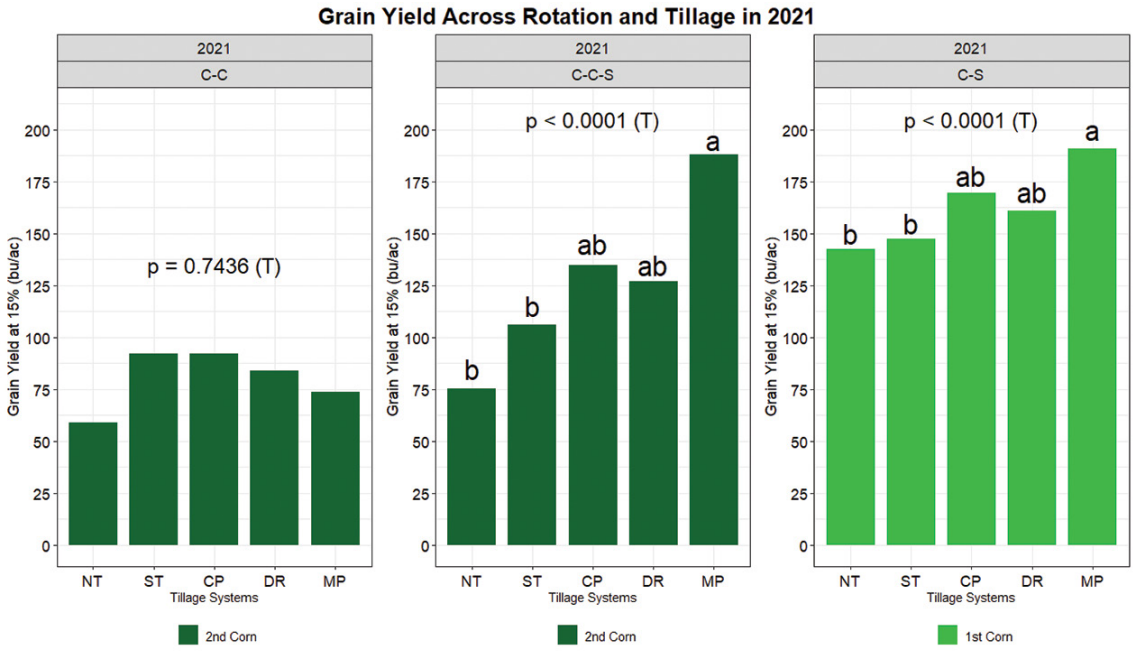
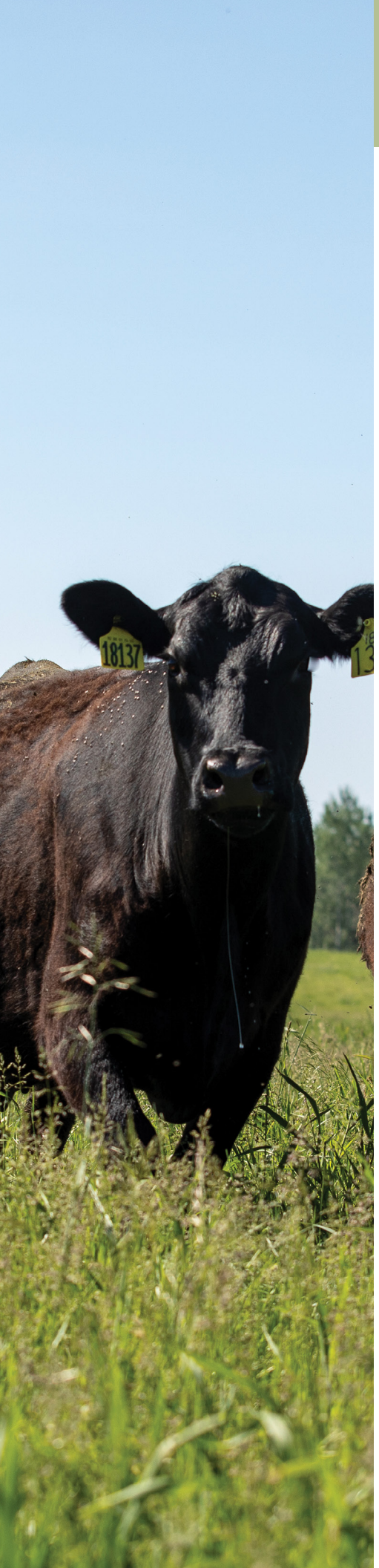


Figure 1. Grain yield in 2021 from the tillage systems within each crop rotation. Yields that are significantly different at P < 0.05 have different letters.

Figure 2. Grain yield in 2022 from the tillage systems within each crop rotation.

Key Takeaways

- In 2021, the second year corn in the corn-corn-soybean rotation and the corn in the corn-soybean rotation had similar yield patterns across tillage practices ($p < 0.0001$). However, on average, the second year corn yields were lower than the first year corn. Moldboard plow was the only treatment that yielded almost the same in both rotations.
- In both years, the continuous corn rotation did not have statistical difference between tillage practices.
- In 2022, soybean yields in both the corn-corn-soybean rotation and the corn-soybean rotation did not have any statistical differences between tillage practices.



Southern Iowa Grazing and Forage Budgets for Beef Cows

Logan Wallace—farm co-manager

Southern Iowa soils and topography are conducive to pasture and beef cattle. The Iowa State University McNay research farm is located in this region.

The McNay farm has a beef cow herd used for research purposes. The cows and replacement heifers are grazed predominantly on improved cool-season grass pastures. There are approximately 300 spring-calving cows and 100 fall-calving cows. Grazing season is mid-April to mid-October or about six months (180 days), dependent on grass growth in the spring.

Materials and Methods

Animal units for the various beef cattle types are shown in Table 1. The McNay cattle inventory (herd) for 2021 and 2022 is shown in Table 2 and Table 3, respectively. In 2021, there were 484 head (372 cows, 97 yearling heifers, and 15 bulls) (Table 2). In 2022, there were 451 head (396 cows, 65 yearling heifers, and 17 bulls) (Table 3).

In 2021 and 2022, head of cattle multiplied by grazing days equals total grazing days, which when multiplied by the Animal Unit (AU) value for the type of cattle equals total AU days by type. When all AU days are summed, the total AU grazing days for the farm for the season is generated.

In 2021, there were 99,805 AU grazing days (Table 2). In 2022, there were 103,646 AU grazing days or 3.7% more (Table 3). This was due to greater numbers of mature cattle grazing and earlier grazing of some of the herds.

The McNay farm has 690 acres of improved grass legume pasture plus additional unimproved pastures that include river bottom, timber, ditches, and lots. The additional unimproved areas were valued as the equivalent of 361 acres of improved pasture in 2021 and 2022 for a total of 1,051 acres improved pasture equivalent.

Table 1. Animal unit for beef cattle type.

Pair (1,200 lb. cow + calf)	1.50
2-year old (1,000 lb. cow + calf)	1.20
Yearling (750)	0.75
Dry cow (1,200 lb.)	1.20
Mature bull (1,800 lb.)	1.80
1,000 lb. cow (3% intake)	1.00

Table 2. 2021 spring/summer grazing including: cattle inventory, grazing days, total grazing days, animal unit (AU), and total AU days.*

Type	Head	Days	Total days	Animal unit	Total AU days
6+ year-old cow	95	172	16,340	1.50	24,510
3-5 year-old cow	95	163	15,485	1.50	23,228
2 year-old cow	67	164	10,988	1.20	13,186
Yearling heifer	97	182	17,634	0.75	13,241
Fall calving cow	115	177	20,355	1.20	24,426
Bull (breeding season)	15	45	540	1.80	972
Total	484		81,497		99,805

*Grazing season April 16 to October 15 depending on the herd.

Table 2. 2022 spring/summer grazing including: cattle inventory, grazing days, total grazing days, animal unit (AU), and total AU days.*

Type	Head	Days	Total days	Animal unit	Total AU days
6+ year-old cow	95	173	16,435	1.50	24,653
3-5 year-old cow	129	173	22,317	1.50	33,476
2 year-old cow	59	173	10,207	1.20	12,248
Yearling heifer	65	173	11,245	0.75	8,434
Fall calving cow	113	173	19,539	1.20	23,439
Bull (breeding season)	17	45	765	1.80	1,377
Total	476		80,518		103,646

*Grazing season April 25 to October 15 depending on the herd.

Results and Discussion

For 2021, the 99,805 total AU grazing days divided by 1,051 acres equals 77 AU grazing days/acre. The 81,497 total grazing days divided by 1,051 acres equals 61 cow grazing-days/acre.

For 2022, the 103,646 total AU grazing days divided by 1,051 acres equals 99 AU grazing days/acre. The 80,518 total grazing days divided by 1,051 acres equals 77 cow days/acre.

Soybean Breeding Program Update

Asheesh Singh—professor, Department of Agronomy

Brian Scott—agricultural specialist, Department of Agronomy

Jennifer Hicks—research scientist, Department of Agronomy

Ryan Dunn—agricultural specialist, Department of Agronomy

David Zimmerman—research associate, Department of Agronomy

The Iowa State University soybean breeding program started in 2014. The focus of this program is to develop soybean varieties for Iowa and Midwest farmers. Additionally, researchers are active in scientific discovery and tool development related to breeding and crop production. The group consists of graduate and undergraduate research students who are going to become the next generation scientists and breeders capable in agriculture, engineering, and data sciences related topics. The work this group does on the ISU farms is critical for their success, as this generates valuable research and breeding data. Since inception, this group has commercialized four soybean varieties that are suitable for food grade market, which can provide a higher premium to farmers. The group is very appreciative of the support received from farm staff and managers. There were over 40,000 variety plots on various research farms across Iowa. These research plots supported several graduate students and fellows.

Group mission. To educate the next generation of breeders in agriculture, engineering, and data science to develop tools and technologies that advance science and empower farmers to increase profitability and sustainability.

Group research goals. To improve agricultural production and positively impact farmers and the agriculture industry through the development of new products (cultivars, germplasm, methods, tools), gene discovery, and research insights on pertinent topics. Specifically, breeding non-GM and food-grade soybean.

Update. The group is preparing to commercialize one new variety in 2022-2023, and foundation seed production was completed in fall 2022. This new variety combines good seed yield with high protein, higher sucrose, low raffinose, low stachyose, and larger seed size. It has a maturity rating of mid-MGII and will meet the need of companies and farmers interested in growing a food grade soybean, due to its clear hilum color along with a combination of yield, protein, carbohydrate and seed size traits.

Earlier, three varieties, IAS19C3, IAS25C1, and IAS31C1, were commercialized. IAS19C3 is a high yield and high protein line with yellow hilum, while IAS25C1 and IAS31C1 are high yielding yellow hilum varieties with soybean aphid tolerance. A continuous output of new varieties catering to the need of soybean farmers is expected. Twenty-two research papers were published in the past two years on soybean helping advance digital and precision agriculture, disease and stress protection, yield enhancement and better methods, tools, and breeding approaches. Ten graduate students have completed their degree, and are pursuing various jobs in public or private sector or continuing their education.

Acknowledgements

The research farm team sincerely thank the funding support received from the Iowa Soybean Association, United Soybean Board, North Central Soybean Research Program, USDA-NIFA, USDA Hatch, National Science Foundation, and Iowa State University (R F Baker Center, Iowa Soybean Research Center, and Plant Sciences Institute).