

2023 WEED REPORT

Nachusa Grasslands

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Summary

It was another record year for treating weeds at Nachusa, covering 7,300 acres in total. The bulk of this coverage was carried out by full-time staff in the tractor, which covered larger areas faster than the seasonal crews on foot. Still, the crew swept more acres with backpack sprayers than last year, up 1022 acres from 771. It should be noted that the acres data presented in all following tables in this report simply indicate the area swept, and they do not mean weeds were found or herbicide was sprayed in this entire area. For example, almost 100 acres were recorded in Holland Prairie under the “Backpack” treatment action, but in reality, these were swept for ABC using a UTV. No plants were found, and no herbicide was used.

Similarly, the acres that a tractor swept covers the acreage traversed back and forth across prairie plantings with few weeds. Very little herbicide or mowing are applied on those acres. The tractor is essentially a slow-moving observation cockpit where we are looking for weeds. The large herbicide gallons sprayed is seen with the “Tractor Big Boom” where we are spraying entire brome grass fields that are in Conservation Reserve Program.

The crew on foot with backpacks only used 454 gallons of dilute herbicide sweeping almost 3,000 acres. For comparison, a farmer treating a corn or soy field might spray 60 gallons of dilute herbicide per acre.

All weed occurrences are entered in GIS Field Maps, typically as point occurrences. So, a Field Map of a planting with a few hundred plants of birdsfoot trefoil will look busy with occurrences dots. After we sweep that prairie planting, we enter that data in Field Maps with a polygon drawn around the field we swept. Sweeping is walking in an orderly way across a habitat to try and see all of it. In Field Maps we have made drop down menus to help us track things like which herbicide was used, at what percentage, or did we spade out weeds, and other helpful comments. This layer of weeds managed starts off blank in the spring and becomes very colorful by the end of each year.

Treatment	Acres	Hours Spent	Herbicide Used (gal)	Gal/Acre	Acre/Hr	Hr/Acre
Second Sweep	1907.76	143	89	0.05	13.34	0.07
Mowed	1759.73	111	1	0.00	15.85	0.06
Tractor JD9	1317.63	135	1865	1.42	9.76	0.10
Backpack	1021.74	278	364	0.36	3.68	0.27
Tractor Big Boom	696.93	56	3592	5.15	12.45	0.08
Basal Bark	391.46	182	377	0.96	2.15	0.46
Tractor Boomless	107.67	16	433	4.02	6.73	0.15
Spade	94.16	19	1	0.01	4.96	0.20
Fecon	2.52	4	0	0.00	0.63	1.59
Other	0.26	5	1	3.84	0.05	19.20
Third Sweep	0.24	1	0	0.00	0.24	4.16
Total	7300.11	950	6723	-	-	-

Table 1: Summary of weed treatment methods used in 2023. Acres represent acres swept and do not equate to acres where herbicide was sprayed; some acres were densely covered with weeds,

and some were empty. “Second Sweep” does not specify management type; it represents resweeping an area that was already swept with one of the specified treatment methods.

Weed Species

Firstly, Tables 2-4 represent data where the species shown was entered as the primary target for a given area (Weed Species 1, in Field Maps). The species category “Other” represents weeds besides those found in the drop-down menu selection in Field Maps, and instances other than targeting weeds directly. For example, the majority of the herbicide used for “Other” weeds was sprayed pretreating the site of the 2023 crew planting, 520 gallons in June and 460 gallons in August, taking only 4 hours between both events. This explains why it has the highest herbicide use with one of the lowest hours spent and acres covered. For this reason, this weed category is not considered in the following discussion about weed data. Also, the data for yellow and white sweet clover may be skewed, because these two weeds are usually treated simultaneously.

Reed Canary was the most resource intensive, costing us the most worker hours and the most herbicide of any other weed. The sweet clovers, BFT, and ABC follow closely behind. This is expected for the weeds which have made up the bulk of our summer stewardship. The final two columns of Table 1 may allude to the density of patches where we find these weeds. For example, reed canary grass, which we know grows densely when allowed, has some of the highest gallons per acre and hours spent per acre.

Weed Species	Hours Spent	Herbicide Used (gal)	Acres	Gal/Acre	Hr/Acre
Reed Canary	119	1057	368.78	2.87	0.32
Yellow Sweet Clover	118	861	1867.42	0.46	0.06
White Sweet Clover	117	284	2009.15	0.14	0.06
BFT	111	719	817.97	0.88	0.14
Asian Bushclover	102	971	538.33	1.80	0.19
Honeysuckle	101	353	222.56	1.59	0.45
Mesophytic Trees	61	193	137.81	1.40	0.44
King Devil	48	77	308.91	0.25	0.16
Other	42	1439	214.01	6.72	0.20
Poison Hemlock	26	68	134.58	0.51	0.19
Total	845	6022	6619.51	-	-

Table 2: Summary of resource use by weed species, showing top 10 time intensive species. “Other” species represents multiple species less common on the preserve, as well as non-weedy targets such as pre-treating crew planting site.

Tables 3 and 4 show how important of a tool the tractors have become in our weed management abilities. Note, the order of the most time intensive weeds changes in Table 3 because Second Sweep and Third Sweep data was removed. This reveals that our weed resweeps were mainly focused on ABC, BFT, and white sweet clover (especially white sweet clover, 75 hours spent on second and third sweeps for this species alone). Tractors (understandably) covered more acres per hour than on-foot methods, but they also used much more herbicide per

acre. This is because of the less precise nature of tractor spraying techniques, such as the big boom sprayer. This makes the tractor a valuable resource in tackling large, densely populated patches of weeds around the preserve, as long as terrain is fairly consistent. On-foot management methods are more appropriate when we need more thorough sweeps which, while they may take longer, conserve herbicide and target species that are harder to see from a tractor, like ABC.

Weed Species	Hours Spent	Herbicide Used (gal)	Acres	Gal/Acre	Hr/Acre
Reed Canary	119	1057	368.78	5.01	0.74
Foot	72	157	134.67	1.17	0.53
Tractor	47	900	234.11	3.84	0.20
Yellow Sweet Clover	114	861	1837.82	0.61	0.18
Foot	18	16	143.40	0.11	0.13
Tractor	96	845	1694.42	0.50	0.06
Honeysuckle	101	353	222.56	3.01	0.68
Foot	97	268	158.14	1.69	0.61
Tractor	4	85	64.42	1.32	0.06
Asian Bushclover	91	960	514.49	5.90	0.28
Foot	83	39	355.47	0.11	0.23
Tractor	8	921	159.02	5.79	0.05
BFT	61	645	630.49	1.75	0.29
Foot	42	94	165.40	0.57	0.25
Tractor	19	551	465.08	1.18	0.04
Mesophytic Trees	61	193	137.81	3.37	0.77
Foot	52	70	90.41	0.77	0.58
Tractor	9	123	47.40	2.60	0.19
King Devil	48	77	308.91	0.74	0.26
Foot	42	27	228.47	0.12	0.18
Tractor	6	50	80.44	0.62	0.07
White Sweet Clover	42	284	379.73	0.92	0.31
Foot	9	4	42.99	0.09	0.21
Tractor	33	280	336.75	0.83	0.10
Other	41	1438	213.60	14.67	0.39
Foot	18	18	115.74	0.16	0.16
Tractor	23	1420	97.86	14.51	0.24
Poison Hemlock	24	68	97.47	1.94	1.16
Foot	6	8	6.22	1.29	0.97

Tractor	18	60	91.26	0.66	0.20
Total	702	5936	4711.66	-	-

Table 3: Breakdown of Table 2, showing resources spent on foot and in the tractor. Data from “Second Sweep” and “Third Sweep” treatment methods were not included, as they do not specify the treatment technique used in resweeps.

Weed Species	Hours Spent	Herbicide Used (gal)	Acres	Gal/Acre	Hr/Acre
Reed Canary	119	1057	368.78	2.87	0.32
Backpack	72	157	134.67	1.17	0.53
Tractor Big Boom	5	170	12.36	13.76	0.40
Tractor Boomless	5	140	8.28	16.91	0.60
Tractor JD9	37	590	213.47	2.76	0.17
Yellow Sweet Clover	118	861	1867.42	0.46	0.06
Backpack	8	16	90.52	0.18	0.09
Mowed	73	0	1391.77	0.00	0.05
Second Sweep	4	0	29.60	0.00	0.14
Spade	10	0	52.88	0.00	0.19
Tractor Big Boom	11	540	138.28	3.91	0.08
Tractor Boomless	7	250	90.71	2.76	0.08
Tractor JD9	5	55	73.65	0.75	0.07
White Sweet Clover	117	284	2009.15	0.14	0.06
Backpack	3	3	9.46	0.32	0.32
Mowed	21	0	238.51	0.00	0.09
Second Sweep	74		1629.18	0.00	0.05
Spade	6	1	33.53	0.03	0.18
Third Sweep	1	0	0.24	0.00	4.16
Tractor Big Boom	8	220	65.52	3.36	0.12
Tractor JD9	4	60	32.72	1.83	0.12
BFT	111	719	817.97	0.88	0.14
Backpack	42	94	165.40	0.57	0.25
Second Sweep	50	74	187.48	0.39	0.27
Tractor Big Boom	10	450	241.27	1.87	0.04
Tractor JD9	9	101	223.82	0.45	0.04
Asian Bushclover	102	971	538.33	1.80	0.19
Backpack	83	39	355.47	0.11	0.23
Mowed	1	1	4.92	0.20	0.20
Second Sweep	11	11	23.84	0.46	0.46
Tractor Big Boom	7	920	154.10	5.97	0.05
Honeysuckle	101	353	222.56	1.59	0.45
Basal Bark	97	268	158.14	1.69	0.61

Tractor JD9	4	85	64.42	1.32	0.06
Mesophytic Trees	61	193	137.81	1.40	0.44
Basal Bark	52	70	90.41	0.77	0.58
Tractor Boomless	2	18	5.74	3.14	0.35
Tractor JD9	7	105	41.66	2.52	0.17
King Devil	48	77	308.91	0.25	0.16
Backpack	42	27	228.47	0.12	0.18
Tractor JD9	6	50	80.44	0.62	0.07
Other	42	1439	214.01	6.72	0.20
Backpack	8	2	22.59	0.09	0.35
Basal Bark	10	16	93.15	0.17	0.11
Mowed	2	0	0.35	0.00	5.64
Second Sweep	1	1	0.40	2.48	2.48
Tractor Big Boom	11	1220	76.84	15.88	0.14
Tractor Boomless	2	25	2.94	8.50	0.68
Tractor JD9	8	175	17.73	9.87	0.45
Poison Hemlock	26	68	134.58	0.51	0.19
Backpack	6	8	6.22	1.29	0.97
Fecon	4	0	2.52	0.00	1.59
Mowed	8	0	67.36	0.00	0.12
Second Sweep	2	0	37.11	0.00	0.05
Tractor JD9	6	60	21.37	2.81	0.28
Total	845	6022	6619.51	-	-

Table 4: Further breakdown of Table 2, showing specific management techniques for each weed.

Management Units

Management Unit	Hours Spent	Herbicide Used (gal)	Acres	Gal/Acre	Hr/Acre
Hook Larson	46	539	170.86	3.15	0.27
Juanita Williams	34	114	24.86	4.59	1.37
Big Woods	34	281	69.37	4.05	0.49
East Heinkel	25	52	65.81	0.79	0.38
Clear Creek Knolls	23	44	82.85	0.53	0.28
Clear Creek South	19	22	16.20	1.36	1.17
Stone Barn Prairie	19	56	218.34	0.26	0.09
Oak Island	17	7	59.51	0.12	0.29
West Heinkel	16	8	10.91	0.73	1.47

Fen	16	30	18.79	1.60	0.85
Total	249	1153	737.50	1.56	0.34

Table 5: Summary of top 10 most time intensive management units at Nachusa.

The data in Tables 5 and 6 does not represent the full picture of the different units. 239 of the 355 data entries from Field Maps were blank for Management Unit. Entering the unit when inputting weed management in Field Maps can be improved upon in future years, which would increase the accuracy of the data presented in this section. Hook Larson was our most resource intensive unit, having the highest amount of worker hours and herbicide spent here. This is most likely due to the area's history with ABC, as 80% of the time spent in Hook Larson was dedicated to ABC sweeps. Most sites seem to have their main problem weed, with occasional management for others.

Management Unit	Hours Spent	Herbicide Used (gal)	Acres	Gal/Acre	Hr/Acre
Hook Larson	46	539	170.86	3.15	0.27
Asian Bushclover	37	209	135.50	1.54	0.27
Yellow Sweet Clover	9	330	35.36	9.33	0.25
Big Woods	34	281	69.37	4.05	0.49
BFT	29	278	55.37	5.02	0.52
Reed Canary	5	3	14.00	0.21	0.36
Juanita Williams	33	112	23.73	4.72	1.39
Honeysuckle	30	98	9.75	10.05	3.08
Reed Canary	3	14	13.98	1.00	0.21
East Heinkel	25	52	65.81	0.79	0.38
Reed Canary	20	47	29.01	1.62	0.69
Yellow Sweet Clover	3	5	33.99	0.15	0.09
White Sweet Clover	2	0	2.81	0	0.71
Clear Creek Knolls	22	44	81.17	0.54	0.27
Reed Canary	17	41	46.90	0.87	0.36
White Sweet Clover	3	1	13.72	0.07	0.22
Yellow Sweet Clover	1	0	6.54	0	0.15
BFT	1	2	14.02	0.07	0.07
Stone Barn Prairie	19	56	218.34	0.26	0.09
BFT	13	50	163.09	0.31	0.08

White Sweet					
Clover	3	0	10.71	0	0.28
Other	2	5	44.10	0.11	0.05
Leafy Spurge	1	1	0.44	2.27	2.27
Clear Creek					
South	19	22	16.20	1.36	1.17
Mesophytic					
Trees	18	21	6.92	3.03	2.60
King Devil	1	1	9.28	0.11	0.11
Oak Island	17	7	59.51	0.12	0.29
King Devil	17	7	59.51	0.12	0.29
West Heinkel	16	8	10.91	0.73	1.47
Honeysuckle	13	6	4.16	1.44	3.12
King Devil	2	2	5.63	3.17	0.36
Reed Canary	1	0	1.12	0	0.89
Fen	16	30	18.79	1.60	0.85
Reed Canary	16	30	18.79	1.60	0.85
Total	247	1151	734.69	1.57	0.34

Table 6: Breakdown of Table 5 by weed type

Stewards

Steward	Acres	Herbicide			
		Used (gal)	Hours	Gal/Acre	Hr/Acre
pn	3950.23	2662	231	0.67	0.06
Second Sweep	1639.68	0	73	0.00	0.04
Mowed	1547.78	0	82	0.00	0.05
Tractor JD9	545.85	777	58	1.42	0.11
Tractor Big Boom	121.20	1540	7	12.71	0.06
Tractor Boomless	95.72	345	11	3.60	0.11
Bk	1643.20	3075	197	1.87	0.12
Tractor JD9	591.21	958	64	1.62	0.11
Tractor Big Boom	575.73	2052	49	3.56	0.09
Mowed	211.94	1	29	0.00	0.14
Backpack	148.07	47	40	0.32	0.27
Basal Bark	116.24	17	15	0.15	0.13
Crew	1224.83	678	414	0.55	0.34
Backpack	848.52	311	216	0.37	0.25
Basal Bark	169.34	292	132	1.72	0.78
Second Sweep	146.41	74	51	0.51	0.35

Spade	60.29	1	15	0.02	0.25
Tractor JD9	0.27	0		0.00	0.00
MC	243.67	144	35	0.59	0.14
Tractor JD9	153.08	100	8	0.65	0.05
Basal Bark	90.59	44	27	0.49	0.30
Bk w crew	27.80	0	2	0.00	0.07
Spade	27.80	0	2	0.00	0.07
Total	7089.73	6559	879	0.93	0.12

Table 7: Weed management summary by steward. For Steward names, “pn” is Phil Nagorny, “Bk” is Bill Kleiman, “Crew” is all seasonal crew members, “MC” is Mike Carr. Phil had the most acres swept out of all stewards, having more alone than the rest of the stewards combined. This shows the power of the tractor as a large-scale weed management tool

Management Trends Over the Years

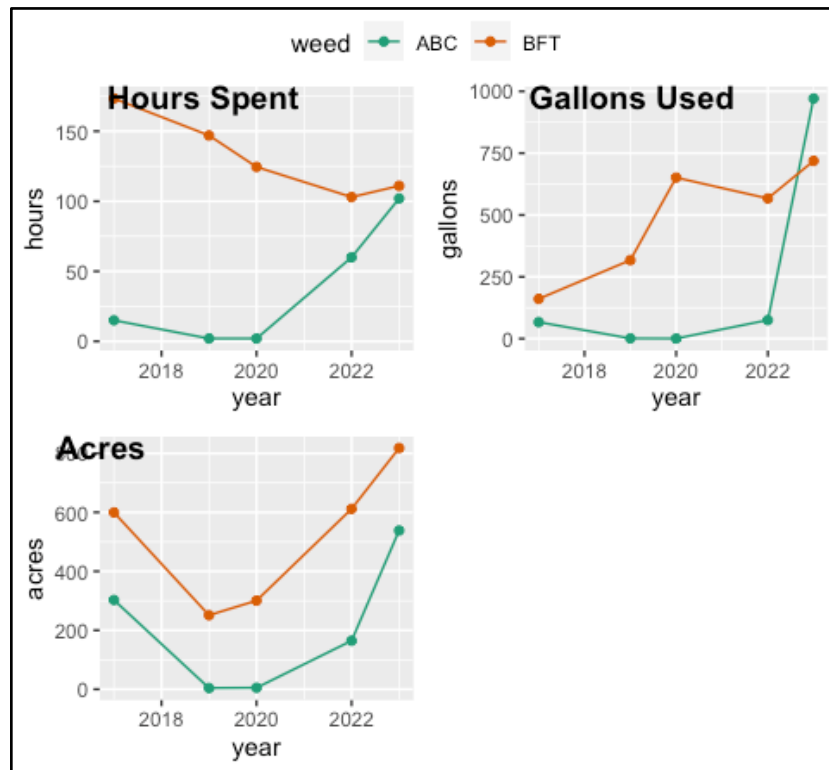


Figure 1: Scatter plots showing changes in hours spent, herbicide used, and acres of management for ABC and BFT since 2017. Data not available for years 2018 and 2021. Data collected from previous years’ weed reports.

We can see in Figure 1 above how management for BFT and ABC have changed over the years. ABC has seen a huge increase in attention over the past couple of years, from almost no recorded management in 2019 and 2020. For BFT, hours spent have decreased while gallons

used has increased, which indicates we may be spending more time on BFT with tractor-based management than with foot crews.

Table 8 shows the most time intensive weed from the past five years (where weed reports are available). We can see how a major focus of ours has been sweet clover, but the decrease in hours spent indicates we may be successfully knocking it back. This could be further supported by the fact that the top weed this year was not sweet clover. The total hours spent on each year's top weed also decreases, possibly showing our weed management has become more diverse and less focused on only a few different weeds.

Year	Top Weed by Hours Spent	Hours Spent
2017	Yellow Sweet Clover	487
2019	Yellow Sweet Clover	462
2020	Yellow Sweet Clover	308
2022	White Sweet Clover	151
2023	Reed Canary Grass	119

Table 8: Top weed by worker hours spent over the past years. Data was pulled from all available weed reports found in T-drive.

Weeds vs. Seeds

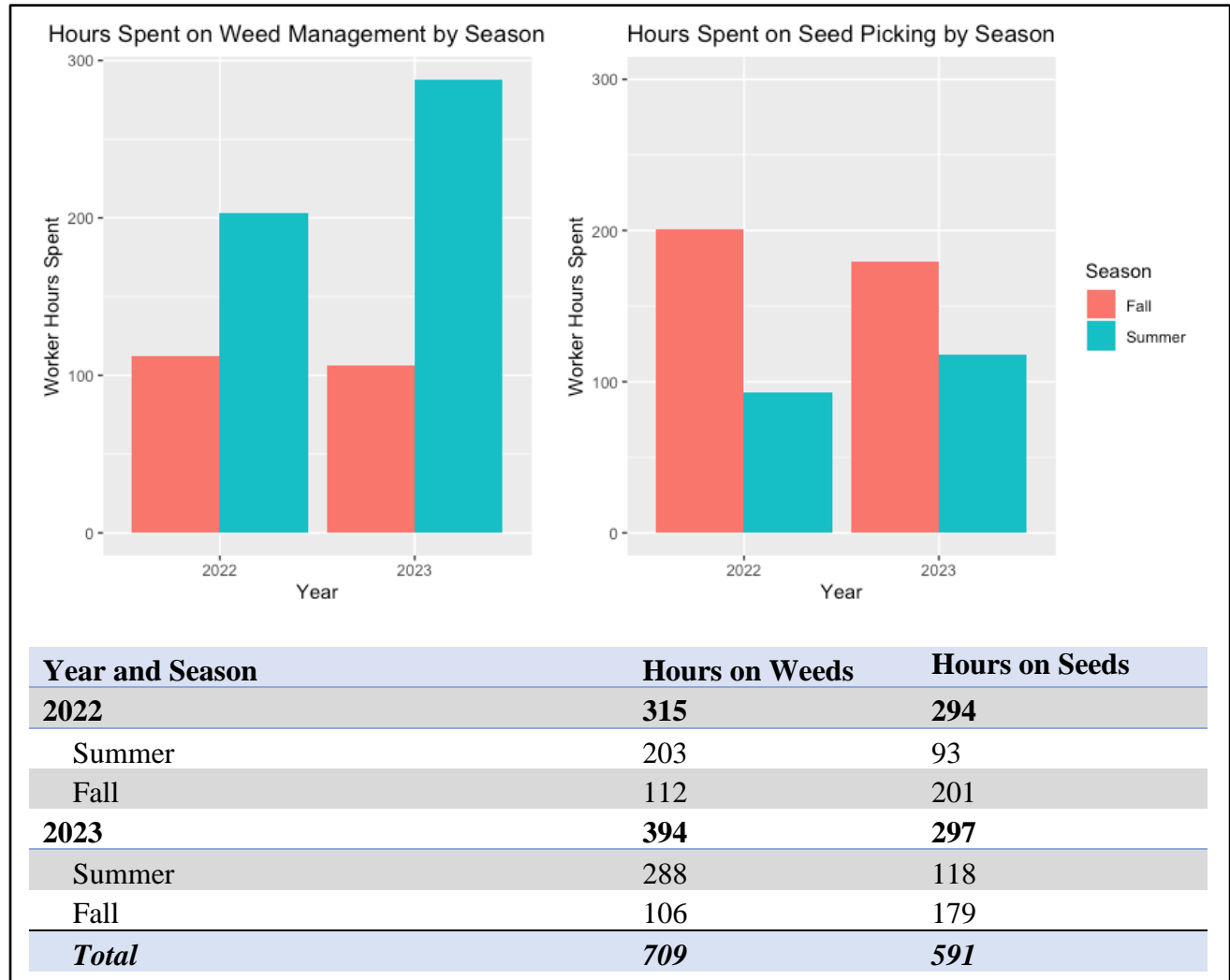


Figure 2: Bar graph showing the allocation of crew hours towards weed management and seed collection, and table with corresponding values. Hours data represents Field Maps entries only with Steward Name: Crew.

Overall, 2023 was a more productive year than 2022, with an increase in hours spent on both weed management and seed collection. Fall 2023 saw a small decrease in hours spent on both weeds and seeds, but this was not as significant as the large increases in hours spent between summer 2022 and 2023. Over the past two years, about 50 minutes were spent on seeds for every hour spent on weeds.

Bill Kleiman addendum thoughts:

Thank you, Jacob, for a thoughtful report! I sometimes write about weed management issues with the GRN blog I manage but let me use this space to capture a few thoughts on weeds from my perspective of three decades of work here.

- Tractor sweeps. For years we have been using tractors to look for and spray patches of invasive reed canary grass, birdsfoot trefoil, or sweet clover which we sometimes mow or spray. In the last few years we have increased our use of the tractor as an observation deck to drive transects back and forth across plantings that we expect to be clean. Phil Nagorny is our major operator here. Phil covered the 500-acres of Clear Creek Knolls, and about 500-acres of Holland Prairie, and some other areas. This allowed the crew to do the more delicate work needed in other areas. The tractor sweeps are not perfect. The driver can miss a single plant, especially if the plant is low growing and not in bloom. So foot patrols of some of these areas should occur at times to try and catch weed occurrences. Also, the tractor must crush an occasional bird nest, maybe a snake, hopefully not a turtle. But crews on foot also step on nests and critters, as do bison and deer. We are balancing our time verses how diverse of habitat we want to sustain.
- Seed harvesting. I am glad Jacob showed how the crew picks seeds. Our volunteers are picking lots of seed too. Typically, we do weeds in the morning and seed harvesting after lunch. This helps us bring in a harvest that we can use to create new habitats, and importantly to overseed areas that are good but could be better with more native plant diversity.
- Pre-emergent herbicide testing. These herbicides are unique in that they kill seeds that emerge into cotyledons. Cotyledon biochemistry is unique and herbicide manufacturers have created several pre-emergent herbicides to exploit this biochemistry. The herbicide we use is called Esplanade 200 SC and is made not to harm perennial plants. In 2023 we tried boom spraying a few prairie planting that are thick with birdsfoot trefoil (*Lotus corniculatus*) or Asian bush clover (*Lespedeza daurica*). These fields we see as resource sinks for our crew time. Our hypothesis is that if the herbicide killed emerging seedlings for a few years, we might be able to find the hours to treat the adult weeds and get ahead of the problem. The herbicide kills cotyledons of both weeds and native species, so it is not a herbicide to apply for years. This year, our casual observations were that we did not see a difference in treated vs un-treated fields, but we would like to do more intensive quadrat sampling in the future. We plan to treat these same fields again by early April 2024.
- Happy Warriors. I enjoy weed management most of the time. Every year I try to do a good job, along with others here. At times it feels daunting, but we end each year feeling we did well. Don't be sad, be a happy warrior.
- Prioritizing weeds: To me Asian bushclover (ABC) is our highest priority weed. ABC was brought here from a seed lot purchased from a native plant nursery where they were apparently harvesting from McCune Sand Prairie in Bureau County. If you know *Lespedeza cuneata*, this ABC is a low growing version of that invasive legume. Low growing means it is tough to locate. We want to get it in control. My next priority is birdsfoot trefoil (BFT) because it is known for becoming very abundant and has seeds that last decades in the soil. If you have hiked around our Big Jump Prairie, you have seen huge swards of BFT. BFT was planted there to "improve" the pasture in the 1980s. Our strategy there is containment to its core areas, so we treat the outliers and the fire breaks only. Reed canary grass (*Phalaris arundinacea*) is next in priority as it can form monocultures and has been a challenge for us to keep in check. Sweet clovers are important weeds, but we have so far kept their numbers down with persistent work, often while sweeping for ABC and BFT in the same places. GIS Field Maps has been a great

tracking tool for us. Before Field Maps we had desktop GIS maps which were sometimes generic in locations of weeds and our treatment tracking was brief and based more on our collective memories and some early GPS tracking devices. Field Maps is powerful and cool to use in the field on your phone. This report data comes mostly from Field Maps.

I will end here. Thank you again, Jacob. - BK