Cabbage Research and Development Program
2022-2023 Proposal

Funding Period April 1, 2022-March 31, 2023

Project Title:

Optimizing Herbicide Weed Control and Crop Safety in Transplanted Cabbage

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Continued Research ☒

Amount Requested: $8,500

Is this a duplicate submission to another entity Yes ☐ No ☒

If this is a multiple year project, the following **MUST** be completed:

- Year in which project began: 2017 (Telenko & Hoepting), 2018 (Wallace), 2019 (Hoepting), 2020 & 2021 (Sosnoskie & Hoepting)
- Anticipated years remaining for project: as necessary
- Estimated total cost of project: $7,000 to $10,000 per year

Project Summary:
Weed escapes compete with the cabbage crop for nutrients and can directly cause yield loss, as well as interfere with harvest operations. Additionally, weed seeds can contaminate cabbage heads, reducing their quality and increasing the labor required to clean them up. Brassica weeds such as Shepherd's purse and marsh yellowcress can harbor diseases including Alternaria leaf spot, bacterial black rot and club root, which can spread to the cabbage crop, as well as carry them over to the next cabbage crop grown in rotation. With labor issues on the rise including availability of workers, increased minimum wage and minimum 60-hour work week, **reducing the need to hand weed cabbage would be desirable. Weed management continues to be a high priority for the CRDP.**

Dual Magnum + Goaltender. Dual Magnum is labeled in cabbage from 0.5 to 1.3 pt/A pre-transplant (PRE-T) or within 48 hours of transplanting (POST-T), while Goaltender 0.5-1 pt/A is labeled PRE-T. Goaltender 4-6 fl oz (maximum 8 fl oz per crop) is also labeled for post-emergent weed control from 14 days after planting (DAP) to within 36 days of harvest with a maximum 1 pt amount allowed between PRE-T and POST-T. CRDP-funded on-farm trials from 2019 to 2021 have demonstrated that **Dual Magnum 1 pt + Goaltender 8 fl oz is one of the most effective treatments for broad spectrum weed control** including ragweed (RW), Lamb's quarters (LQ) and mustards, and is the only cabbage herbicide with activity on yellow nutsedge. However, **the crop safety of this combination has been variable.** In 2021, Goaltender 8 fl oz PRE-T + Dual Magnum 1 pt POST-T was safe (0-3.8% injury, maximum 7%) in both plug and bareroot cabbage herbicides trials, but in 2020 this treatment resulted in almost 20% injury from stunting and necrosis. In 2021 trials, Goaltender 8 fl oz + Dual Magnum 1 pt PRE-T reached 26% injury 23 days after treatment (DAT). POST-T application of Goaltender 8 fl oz + Dual Magnum 1 pt had ≤ 10% injury in 2021 and 2019 plug trials, but peaked at 40% in the 2021 bareroot cabbage herbicide trial. Many cabbage growers prefer to apply at-planting herbicides in a single pass instead of both PRE-T and POST-T with POST-T generally being preferred because it avoids disturbing the herbicide layer on the soil surface during transplanting activities. **It would be worthwhile to explore reducing risk of crop injury from Dual Magnum + Goaltender by trying split applications of Dual Magnum and delaying application of Goaltender 3-4 days POST-T. It is also worthwhile to investigate the effect of a second application of Goaltender 6 fl oz applied 14-21 DAP on crop injury and weed control.**

Other treatments that demonstrated broad spectrum weed control comparable to Dual Magnum 1 pt + Goaltender 8 fl oz in the 2021 trial included Prowl H2O 2 pt + Goaltender 8 fl oz, Prowl H2O 2 pt + Chateau 1 oz, and Trifluralin 1 pt + Spartan 6 fl oz. In 2019-2021 CRDP-funded on-farm trials, compared to Goaltender, Spartan has provided better control of Lamb's quarters (LQ) and grasses with less crop injury. It also has activity on yellow nutsedge and excellent tank mix compatibility with Prowl H2O. **Unfortunately, we will have to cease testing Spartan in NY, due to groundwater issues with its active ingredient, sulfentrazone.**

Prowl H2O. Prowl H2O is labeled in cabbage as a directed row middle spray. In 2019-2021 CRDP-funded on-farm field trials, it demonstrated very good to excellent control of LQ, and was better than Treflan, Devrinol and Dual Magnum. It has been shown to have very good crop safety when applied POST-T alone and in tank mixes with Dual Magnum, Chateau and Spartan. It has also had good crop safety when applied at delayed timings (28 DAP) alone and with Chateau and Spartan, but tank mixes with Goaltender caused greater than 10% injury. Tank mixes of Prowl H2O with either Goaltender or Chateau improved control of pigweed (PW), RW, LQ and grasses. **Delayed application of Prowl H2O with or without Chateau 28 DAP (targeted to after the last nitrogen side-dress application, cultivation and hand weeding, and before row closure) has consistently improved weed control at harvest to**

almost 100%. Since a generic formulation of Prowl H2O, 'Satellite' allows for "broadcast postemergence foliar spray", **we will continue to pursue POST-T and delayed applications of Satellite alone and tank mixed with Chateau for improved season long weed control in cabbage.** Since Satellite has a 70 day preharvest interval, delayed applications would only work for varieties with 98+ days to maturity.

Chateau (a.i. flumioxazin) is another WSSA herbicide group 14 like GoalTender and Spartan. It has excellent activity on PW, Lady's thumb (LT), nightshade (NS) and certain species of annual mustards. Like the other WSSA 14 herbicides, Chateau offers both pre- and post-emergent weed control. It is labeled in cabbage in other states as a directed row middle spray. There may be interest in getting cabbage added to the label in NY, especially if herbicide-resistant Palmer amaranth becomes a problem (Chateau is excellent on PW). In 2018 and 2019 CRDP trials, Chateau at 1 oz/A had very good crop safety POST-T both at-planting and 28 DAP, both alone and tank mixed with Prowl H2O 2 pt. In 2019, it was safer in combination with Trifluralin, Devrinol and Prowl H2O than Goaltender, while Chateau 1 oz + Dual Magnum 1 pt killed cabbage plants. When Chateau was tank mixed with Prowl H2O it improved control of RW and LQ. **Since Chateau has demonstrated good crop safety, it is worthwhile to continue to explore Chateau for improved weed control in cabbage.**

Soil adjuvants are supposed to improve the efficacy and adsorption of soil-applied herbicides by providing even distribution including into hydrophobic zones (pockets of soil that don't wet easily) and by keeping pre-emergent herbicides in the weed germination zone, so that there are fewer weed escapes. As herbicide resistance to post-emergent herbicides in row crops has increased, growers have been forced to achieve better control with pre-emergent herbicides, and the use of soil adjuvants with pre-emergent herbicides is now more common. In a 2021 muck-onion herbicide trial in Oswego (Hoepting), soil adjuvant Oro-RZ (Ori-Agri USA) was co-applied with two of three pre-emergent herbicide applications in a program. Overall weed control in the treatment that included Oro-RZ was 95% compared to 82% in the treatment without it, because the Oro-RZ improved control of RW and LT. **Based on this initial favorable result, it is worthwhile to investigate soil adjuvant technology for improved performance of pre-emergent herbicides in cabbage.** If effective, soil adjuvants may readily be adopted by NY cabbage growers and immediately improve their weed control in cabbage.

The objective of this project is to optimize crop safety and weed control with herbicides in cabbage production with the goal of providing season long weed control. Sub-objectives include:

1. To optimize use of Dual Magnum and Goaltender for crop safety and weed control.
2. To explore whether Chateau may be incorporated into cabbage herbicide program.
3. To explore utility of delayed applications of Satellite (= Prowl H2O) and Chateau to just after final cultivation and before row closure for extended residual weed control.
4. To explore use of soil adjuvants to improve distribution and retention of surface-applied pre-emergent herbicides, to ultimately improve their efficacy and residual activity in cabbage.

The intended outcome of all of these proposed objectives is to improve weed control while minimizing crop injury so that NY cabbage growers can produce high quality and high yielding cabbage with reduced hand weeding expenses.

<u>Organizational Capacity</u>:

Christy Hoepting has been a Vegetable Specialist with the Cornell Cooperative Extension Vegetable Program since 2001. She now has over 20 years of experience conducting on-farm research studies in

several aspects of cabbage production including variety evaluation, slug control, insect control (thrips, diamondback moth, swede midge, cabbage maggot), Alternaria leaf spot, nitrogen dynamics, and now weed management with herbicides. Christy has completed three years of on-farm cabbage herbicide trials with emphasis on pre-emergent herbicides, but has over a decade of experience conducting onion herbicide trials. She specializes in testing the limits of herbicide rate and timing for crop safety, and in strategically designing comprehensive herbicide programs for optimal weed control and crop safety. The year 2022 will mark the forth growing season that her Field Technicians, Emma van der Heide and Sarah Caldwell have worked with Hoepting; they have assisted with all aspects of data collection for Hoepting's cabbage and onion research trials, and have become especially astute at herbicide evaluations.

Note: this year, for simplicity, **Hoepting and Sosnoskie are submitting separate proposals to CRDP instead of one proposal with two objectives** to study weed management in cabbage with herbicides. Similar to last year, Sosnoskie will focus on product discovery and development of potential pipeline products/active ingredients with greenhouse and field trials conducted at the Agri-Tech research farm, while Hoepting will continue her research that focuses on optimizing weed control and crop safety with labeled products while integrating pipeline products into herbicide programs in on-farm field trials.

Objective 1:
To optimize crop safety and weed control with herbicides in cabbage production with the goal of providing season long weed control.
Sub-objectives include:

1. To optimize use of Dual Magnum and Goaltender for crop safety and weed control.
2. To explore whether Satellite and Chateau may be incorporated into cabbage herbicide program with emphasis on substituting them for Dual Magnum.
3. To explore utility of delayed herbicide applications to just after final cultivation and before row closure for extended residual weed control.
4. To explore use of soil adjuvants to improve distribution and retention of surface-applied pre-emergent herbicides, to ultimately improve their efficacy and residual activity in cabbage.

Task 1.1
Trial Set-up. A small-plot trial will be set up in commercial cabbage field that is grown from plug transplants. Ideally, the trial will be set up in May, similar to 2020 and 2021 in a field of summer cabbage that will ensure peak weed pressure in the spring, and harvest in late-August/early-September. The trial will be set up as a randomized complete block design with 4 replicates and 25 treatments including a nontreated and a hand weeded control (Table 1). Individual plots will be 2 rows of cabbage wide by 10 feet long, with an untreated row of cabbage between plots and 3 feet between tiers. Herbicides will be applied using a CO_2 backpack sprayer at 40 gpa and 32 psi using three TeeJet 8005 VS flat fan nozzles spaced 19-in. apart. We will apply the herbicides within a day of the trial area being planted. For pre-transplant (PRE-T) treatments, we will pull out freshly planted plug transplants, spray the plot, and then re-plant the plug transplants.

A note on herbicide injury between plug and bareroot transplanted cabbage. Cabbage was grown from plug transplants in the 2019 trial and from bareroot transplants in the 2020 trial. In 2019, pre-plant incorporated (PPI) applications of Trifluralin 1 pt and Devrinol 2XT 4 pt were safe to cabbage plants grown from plug transplants. Alternatively, in 2020, these treatments were injurious to cabbage grown

from bareroot transplants, where we observed 13-20% crop stunting 7 and 14 days after treatment. In 2020, we also observed stunting in treatments where bareroot transplants were transplanted into PRE-T treatments of Goaltender and Spartan. In 2021 trials, Trifuralin 1 pt and 2 pt/A and Devrinol 2XT 4 pt applied PPI were safe on both cabbage grown from plug and bareroot transplants. The only treatment that differed in crop safety between plug and bareroot transplants in 2021 was Dual Magnum 1 pt + Goaltender 8 fl oz POST-T, which resulted in significantly more injury in bareroot transplants. Although it remains unknown why **stunting injury occurred in bareroot transplants in 2020 with PPI treatments, it appears to be an anomaly.** Thus, **for 2022, we will conduct the study with plug transplants**, since the majority of cabbage in NY is grown from plug transplants.

Treatments (Table 1).
Since Treflan pre-plant incorporated (PPI) and Command are standard treatments used in commercial cabbage production, **all of our treatments will include Trifluralin 1 pt/A PPI and Command 3ME 8 fl oz/A.** 2022 will be the first year that Command is included in our treatments.

Dual Magnum + Goaltender. We will repeat from 2021 the three different timing treatments of Dual Magnum 1 pt + Goaltender 8 fl oz, which include both products PRE-T and POST-T, and Goaltender PRE-T followed by (fb.) Dual Magnum POST-T. We will also add Dual Magnum PRE-T fb. Goaltender POST-T (Nos. 3-6). Of these, we hypothesize that both products POST-T will cause the most injury (No. 4), while Goaltender 8 fl oz PRE-T fb. Dual Magnum 1 pt POST-T (No. 6) will cause the least crop injury. **To determine the effect of reducing the rate of Goaltender** on crop safety and weed control, we will substitute Goaltender 8 fl oz for Goaltender 4 fl oz in each of these treatments (Nos. 7 and 8). **To determine the effect of reducing the rate of Dual Magnum when tank mixed with Goaltender 8 fl POST-T**, we will reduce rate of Dual Magnum to 0.5 pt (No. 9). Another strategy to possibly **reduce crop injury in Dual Magnum + Goaltender 8 fl oz POST-T without reducing total rate of Dual Magnum** is to split the Dual Magnum between PRE-T and POST-T at 0.5 fl oz each (No. 10). We will also try **splitting the rates of both Dual Magnum and Goaltender between PRE-T and POST-T** (No. 11). Finally, to determine the **effect on crop safety and weed control of post-emergent treatment of Goaltender following Dual Magnum + Goaltender at-planting**, we will apply Goaltender 6 fl oz 14 DAP following high- and low-risk of crop injury at-planting Dual Magnum + Goaltender treatments (Nos. 12 and 13).

Satellite and Chateau. We will repeat treatments from the 2021 trial that were as effective as Dual Magnum + Goaltender, which include Satellite 2.1 pt + Goaltender 8 fl oz POST-T (No. 14) and Satellite 2.1 pt + Chateau 2 oz POST-T (No. 15). Additionally, to see if we can further improve weed control with post-emergent timings, we will apply Chateau 1 oz 14 DAP following Satellite + Goaltender POST-T (No. 16), and Goaltender 6 fl oz 14 DAP following Satellite + Chateau POST-T (No. 17). We hypothesize that the cabbage will more readily grow out of necrosis type injury caused by the WSSA group 14 herbicides than it would grow out of the stunting injury caused by Dual Magnum.

Delayed herbicide applications. Satellite 2.1 pt alone, Chateau 1 oz alone, and a tank mix of the two will be applied after the last nitrogen side-dress and cultivation and before row closure, at approximately 28 DAP. These delayed treatments will follow the two Dual Magnum + Goaltender at-planting treatments that we anticipate will cause the least stunting injury: 1) Goaltender 8 fl oz PRE-T fb. Dual Magnum 1 pt POST-T (Nos. 18-20); and 2) Goaltender 8 fl oz + Dual Magnum 0.5 pt PRE-T fb. Dual Magnum 0.5 pt POST-T (Nos. 21-23).

Soil adjuvants. Two soil adjuvants, Oro-RZ 1 pt (Ori-Agri) and Grounded 2.5 pt (Helena) will be added to each of three pre-emergent timings of Goaltender 8 fl oz PRE-T fb. Dual Magnum 1 pt POST-T fb. Satellite 2.1 pt 28 DAP (Nos. 24 and 25). These treatments will be compared to treatment No. 18 (Goaltender 8 fl oz PRE-T fb. Dual Magnum 1 pt POST-T fb. Satellite 2.1 pt 28 DAP with no adjuvant) and will give us three opportunities per treatment to evaluate the adjuvants' potential effects on different herbicides, under different application conditions.

Evaluation. Crop injury in terms of necrosis, puckering and stunting will be visually assessed compared to guard rows using a 100% scale (0% = no injury, 100% = all plants dead) 7, 14, 21, and 28 days after treatment. Percent weed control by species will be visually estimated compared to guard rows 28 DAP for at-planting and 14 DAP treatments. After this assessment, nitrogen will be applied as a side-dress and the whole trial will be cultivated and hand weeded. After hand weeding, the 28 DAP treatments will be applied. Weed control by species will be assessed at harvest by visual estimate of % control, fresh biomass, or ground cover using whichever variables are appropriate, always using the weed pressure in the guard rows for comparison. Each marketable cabbage head per plot will be weighed individually. Differences among treatments will be analyzed using general analysis of variance (ANOVA) and means will be separated using Fisher's Protected LSD test with 95% confidence interval.

Extension and Outreach. Results will be shared with CRDP board and with rest of NY cabbage industry as appropriate. Potentially, new recommendations will be made for developing safe and effective herbicide programs in cabbage. Such information will be made available via a newsletter article published in Extension newsletters or direct emailing, and/or a "cheat sheet" that will be available on the CCE CVP website. Presentations may be made at grower meetings. If the on-farm cabbage herbicide trial is "showy", cabbage growers and allied industry representatives will be invited for a trial tour, likely either at 28 DAP or at harvest.

Performance Measure 1.1.1
Late-May, 2022. Set up cabbage herbicide trial in commercial cabbage field and apply at-plant herbicide treatments.

Performance Measure 1.1.2
June to mid-August, 2022. Collect data on crop injury and weed control. Give trial tour to cabbage industry, if "showy".

Performance Measure 1.1.3
Late-August/Early-September, 2022. Final weed control evaluation. Give trial tour to cabbage industry, if "showy". Harvest trial.

Performance Measure 1.1.4
Fall 2022. Data entry, analysis and summary.

Performance Measure 1.1.4
Winter 2022-23, Early-Spring 2023. Write final report. Report to CRDP. Presentations at winter meeting, Write newsletter article(s), as appropriate.

Table 1. Treatment list for on-farm cabbage herbicide trial, 2022.
All treatments will also get Trifluralin 1 pt PPI.

No.	PRE-T	POST-T 24 h	POST-T 2 weeks	28 DAP
1	Nontreated control			
2	Hand weeded - As needed			
3	**Dual Magnum 1 pt** **+ Goaltender 8 fl oz** + Command 3ME 8 fl oz			
4	Command 3ME 8 floz	**Dual Magnum 1 pt** **+ Goaltender 8 fl oz**		
5	**Dual Magnum 1 pt** + Command 3ME 8 fl oz	**Goaltender 8 fl oz**		
6	**Goaltender 8 fl oz** + Command 3ME 8 fl oz	**Dual Magnum 1 pt**		
7	Command 3ME 8 fl oz	**Dual Magnum 1 pt** **+ Goaltender 4 fl oz**		
8	**Dual Magnum 1 pt** + Command 3ME 8 fl oz	**Goaltender 4 fl oz**		
9	+ Command 3ME 8 fl oz	**Dual Magnum 0.5 pt** **+ Goaltender 8 fl oz**		
10	**Dual Magnum 0.5 pt** + Command 3ME 8 fl oz	**Dual Magnum 0.5 pt** **+ Goaltender 8 fl oz**		
11	**Dual Magnum 0.5 pt** **+ Goaltender 4 fl oz** + Command 3ME 8 fl oz	**Dual Magnum 0.5 pt** **+ Goaltender 4 fl oz**		
12	**Goaltender 8 fl oz** + Command 3ME 8 fl oz	**Dual Magnum 1 pt**	**Goaltender 6 fl oz**	
13	**Dual Magnum 0.5 pt** **+ Goaltender 8 fl oz** + Command 3ME 8 fl oz	**Dual Magnum 0.5 pt**	**Goaltender 6 fl oz**	
14	Command 3ME 8 floz	Satellite 2.1 pt **+ Goaltender 8 fl oz**		
15	Command 3ME 8 floz	Satellite 2.1 pt + Chateau 1 oz		
16	Command 3ME 8 floz	Satellite 2.1 pt **+ Goaltender 8 fl oz**	Chateau 1 oz	
17	Command 3ME 8 floz	**Satellite 2.1 pt** + Chateau 1 oz	**Goaltender 6 fl oz**	
18	**Goaltender 8 fl oz** + Command 3ME 8 fl oz	**Dual Magnum 1 pt**		**Satellite 2.1 pt**
19	**Goaltender 8 fl oz** + Command 3ME 8 fl oz	**Dual Magnum 1 pt**		Chateau 1 oz

20	**Goaltender 8 fl oz** + Command 3ME 8 fl oz	**Dual Magnum 1 pt**		**Satellite 2.1 pt** + Chateau 1 oz
21	**Dual Magnum 0.5 pt** **+ Goaltender 8 fl oz** + Command 3ME 8 fl oz	**Dual Magnum 0.5 pt**		**Satellite 2.1 pt**
22	**Dual Magnum 0.5 pt** **+ Goaltender 8 fl oz** + Command 3ME 8 fl oz	**Dual Magnum 0.5 pt**		Chateau 1 oz
23	**Dual Magnum 0.5 pt** **+ Goaltender 8 fl oz** + Command 3ME 8 fl oz	**Dual Magnum 0.5 pt**		**Satellite 2.1 pt** + Chateau 1 oz
24	Oro-RZ 1 pt **Goaltender 8 fl oz** + Command 3ME 8 fl oz	Oro-RZ 1 pt **Dual Magnum 1 pt**		Oro-RZ 1 pt **Satellite 2.1 pt**
25	Grounded 2.5 pt **Goaltender 8 fl oz** + Command 3ME 8 fl oz	Grounded 2.5 pt **Dual Magnum 1 pt**		Grounded 2.5 pt **Satellite 2.1 pt**

Outcome and Benefits Expected:
The objective of this research proposal is to optimize weed control and crop safety in cabbage by strategically building herbicide programs with currently registered and novel herbicides. Specifically, this project is designed to identify chemical programs that can provide NY cabbage growers with extended, in-season weed suppression that reduces the need for costly labor inputs while maximizing cabbage yield and quality. Improved weed control will reduce need for expensive hand weeding, which can cost $100 per acre just to put a crew through a field, and will eliminate the extra labor required to trim away weed contaminants and diseased leaves from harvested cabbage heads. Further, large weed escapes can interfere with proper deposition of fungicides and reduce aeration within the crop canopy, which results in poorly protected cabbage exposed to more favorable disease conditions. Identifying programs that strategically reduce crop injury without compromising weed control will result in high quality and high yielding cabbage. **Through our pursuit of creative and novel approaches using the current roster of herbicides labeled in New York, we are hoping to pinpoint a program that utilizes 2-4-products, has excellent crop safety, and will result in near-perfect season long control with labeled herbicides.** This will improve the bottom line for NY cabbage growers.

In this proposed project, we will continue to trial Chateau, which has a Special Local Needs label in Georgia. **If our research results indicate that Chateau would be an asset for weed control in cabbage in New York, we will work with Valent to pursue its registration for cabbage in New York**. Similarly, **if this research identifies new herbicide use patterns,** such as a POST-T timing for Goaltender or a delayed application of Prowl H2O/Satellite, that improve weed management with acceptable risk of crop injury, we will **work with the appropriate parties to seek such label changes for their use in New York cabbage production.**

Accomplishments/Benefits to Date:

Herbicide program development has proven time-consuming, because of the many products, timings, rates, and combinations that can be tested. We have generated very good data on ragweed (RW), Lamb's quarters (LQ) and some annual grasses, and we just collected good data on marsh yellowcress in 2021. In grower fields, weed pressure is often patchy and dominated by a couple of species, which makes accurate evaluation of pre-emergent herbicide efficacy challenging. Regardless, we highly value the importance of conducting herbicide trials in commercial cabbage fields with different soil types and weed spectrums, and over multiple years with different growing conditions.

- We have focused on **improved control of ragweed (RW) with pre-emergent herbicides** and identified that a new formulation of Devrinol (2XT) resulted in better RW control than the 50DF formulation and Dual Magnum. Although some growers have trialed Devrinol 2XT, incorporating it into an herbicide program is a challenge because it is a WSSA group 15 herbicide. Dual Magnum, also a WSSA group 15 herbicide, is often used at planting; however using two WSSA 15 herbicides at planting is risky because this chemistry is notorious for causing stunting injury, especially in cold soils. Between Dual Magnum and Devrinol, Dual Magnum offers a wider spectrum of weed control and is often preferred.
- This work also demonstrated the **importance of using Goaltender at planting for improved control of RW, especially when used in combination with Dual Magnum.** We have seen an increase in the use of Goaltender at planting for this purpose, but its risk of injury, especially when used POST-T, can be concerning.
- **Dual Magnum in combination with Goaltender at planting has emerged as the top performing treatment for broad spectrum weed control.** Most of the time we have been able to apply the combination POST-T with acceptable levels of crop injury; however, some applications of this treatment have also resulted in too much crop injury. We are continuing to work with the Dual Magnum/Goaltender combination at-planting by adjusting rates and timing, and trying split applications to see if we can lower the risk of crop injury (e.g. this proposal).
- Our research has highlighted the **potential that Prowl H2O has for improved LQ control** in a cabbage herbicide program. It has also been consistently safe when applied to foliage POST-T within 24 hours of, and 28 days after, planting (despite being labeled as a directed row middle spray). It has also been a safer tank mix partner than Dual Magnum with Goaltender, Chateau and Spartan. This has definitely created more grower interest in, and experimentation with, incorporating Prowl H2O into their cabbage herbicide programs.
- There was **a lot of interest among cabbage growers about Spartan when our trials showed that it had phenomenal control of LQ and very good crop safety** when applied POST-T to foliage within 24 hours and 28 days after planting. FMC even pursued options to get Spartan labeled on cabbage in NY. Unfortunately, NYDEC determined that it could not be registered due to groundwater concerns involving the active ingredient.
- Finally, our experimentation with **delayed applications of pre-emergent herbicides 28 DAP just after nitrogen side-dressing, cultivation, and hand weeding (if necessary), and before row closure have shown tremendous potential to extend residual control through harvest.** Of the different treatments that we have tried at this timing, Prowl H2O appears to be the most feasible at this time. We plan to pursue its use in this manner via the generic formulation of the active ingredient, Satellite, which we will also trial in tank mixes with Goaltender and Chateau in 2022 proposed research.

We have been careful not to make new herbicide recommendations too hastily, as we have experienced a lot of variability in crop injury over the years and we want our recommendations to stand the test of

time. After trials in 2022, we are hoping to be able to provide some new suggestions that NY cabbage growers may use to improve their overall weed control, which will result in reduced labor expenses for hand weeding.

Budget: –

SALARY				
POSITION TITLE (Exempt)	**ANNUALIZED SALARY PER POSITION**		**PERCENT OF EFFORT FUNDED**	**TOTAL**
Sr. Extension Associate Unbanded 11155 (Hoepting Program)	$93,933.00		4.000%	$3,757.00
			Subtotal	$3,757.00
POSITION TITLE (non-Exempt)	**HOURLY PAY RATE PER POSITION**	**STANDARD WORK HOURS PER**	**NUMBER OF WEEKS FUNDED**	**TOTAL**
Technician I, Band A 10952 (Hoepting Program)	$17.64	40	2	$1,411.00
Technician I, Band A 10952 (Hoepting Program)	$17.64	40	2	$1,411.00
			Subtotal	$2,822.00
TOTAL SALARY				
			SALARY TOTAL	$6,579.00

TRAVEL - TYPE/DESCRIPTION	TOTAL
15 trips Albion to Hamlin, 893 total miles @ 0.56/mile (Hoepting Program)	$500.00
TRAVEL TOTAL	$500.00

OPERATING EXPENSES - TYPE/DESCRIPTION	TOTAL
Materials & Supplies - Field and lab supplies	
Stakes, flags, sharpies, sample bags, PPE, CO_2 tank refill etc. (Hoepting Program)	$124.00
OPERATING EXPENSES - TOTAL	$124.00

OTHER EXPENSES - TYPE/DESCRIPTION	TOTAL
Indirect Costs - Direct Costs x 18%	$1,297.00
OTHER EXPENSES - TOTAL	$1,297.00
	$8,500.00

Objective 1: **$8,500**

Budget Justification:

Salary and Wages - $6,579
Sr. Extension Associate (Hoepting Program) : These funds will be used to support trial design, treatment application, data collection, data analysis, and outreach

Technician I (Hoepting Program): These funds will be used to support trial design, treatment application, data collection, data analysis, and outreach

Technician I (Hoepting Program): These funds will be used to support trial design, treatment application, data collection, data analysis, and outreach

Travel - $500
Travel to site plots for treatment application, data collection, data analysis, and outreach.(Hoepting Program)

Other Expenses:$124
Materials and Supplies -Stakes, flags, sharpies, sample bags, PPE, CO2 tank refill, etc.(Hoepting Program)

Other Expenses:$1,297
18% Indirect Costs