EVALUATION OF N-(3,4-DICHLOROPHENYL)-2-METHYLPENTANAMIDE FOR POST EMERGENCE WEED CONTROL IN CELERY

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Control of weeds is requisite in producing celery transplants in seedbeds and in growing the crop to maturity after field setting. Seedbed weeds have been controlled in part by pre-seeding fumigation or by low aromatic petroleum solvents and handweeding after seedling establishment. These options are not completely satisfactory; both plantbed fumigation and repetitious handweeding are expensive. Solvent ("mineral spirits") performance is erratic in effect on celery seedlings and weeds. Effective, economical inter-row weed control results from tillage of the level, friable organic soils of the Florida Everglades. Weeding in the plant row, mainly by cultural equipment, hand labor and mineral spirits, has been expensive and only partly effective. Weed problems after field setting of celery have been minimized by the development of selective pre-emergence herbicides, especially "Vegadex"[1] reported by Guzman[2] in 1957. Although "Vegadex" is used extensively in commercial celery production, it may not afford adequate seasonal weed control unless applied under optimum conditions. Satisfactory, economical control of emerged weeds has remained a problem in the celery seedbed and in the field.

The experimental herbicide N-(3,4-dichlorophenyl)-2-methylpentanamide ("Karsil") effectively controlled many species of annual grass and broadleaf weeds with but temporary injury to transplanted celery in primary herbicide evaluation trials[3,4] in the fall of 1957, and in the spring of 1958. Celery seedlings were moderately tolerant in limited seedbed testing in 1957. Therefore, "Karsil" was evaluated over a two-year period in celery seedbeds and in the field in the Florida Everglades. The data reported herein pertain only to "Karsil" comparisons and in some cases were selected from trials including several other herbicides or combinations.

MATERIALS AND METHODS

Herbicidal chemicals and application rates: The herbicide "Karsil," N-(3,4-dichlorophenyl) -2-methylpentanamide, was originally released as NIA 4562. Frequently, "Karsil" was applied in combination with "Vegadex," 2-chloroallyl diethylthiocarbamate, or was compared with mineral spirits, a low-aromatic hydrocarbon solvent. "Randox," 2-chloro-N,N-diallylacetamide, was a component of control treatments in the commercial field trials. In seedbed experiments "Karsil" (1 to 3 lb/A) was applied alone and in combination with "Vegadex" (1 to 3 lb/A) in aqueous carrier at 40 to 60 gallons per acre (gpa). "Karsil" was evaluated in the range of 1 to 6 lb/A alone and in combinations with "Vegadex" at 2 to 5 lb/A in experiments with field established celery. Materials in most of these experiments were applied with aqueous carrier at 36 to 50 gpa. Mineral spirits was applied to field celery at 50 or 60 gpa, undiluted, alone or with "Vegadex" added at 3 or 4 lb/A.

Application equipment: Seedbed treatments were applied with a compressed air experimental hand sprayer. Primary, secondary and tertiary field evaluations were applied with an experimental tractor herbicide sprayer. Simulated commercial applications were made with farm herbicide sprayers or the experimental tractor depending upon location. Herbicides were applied as broadcast topical sprays or as semi-directed sprays; no effort was made to avoid wetting the celery plants with the treatments.

Treatment plot size: Seedbed experiments. At the primary evaluation level, each 2 x 8 ft. non-replicated treatment plot was adjacent

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[1]"Vegadex" is 2-chloroallyl diethylthiocarbamate. Herbicidal chemicals are designated by trade names and all application rates are in terms of active ingredient as pounds per acre (lb/A).

[2]Guzman, V. L. 1957. Post transplanting weed control of celery in organic soils. Weeds. 5:40-45.

[3]Orsenigo, J. R. 1958. Primary evaluation of pre-and post-emergence herbicides in vegetable and field crops, Fall, 1957. University of Florida, Everglades Station Mimeo Report 59-5.

[4]Orsenigo, J. R. 1958. Primary evaluation of post emergence applied herbicides in vegetable and field crops. Spring, 1958. University of Florida, Everglades Station Mimeo Report 59-6.

to an untreated paired control. Seedlings from these trials were not transplanted to the field. During secondary evaluation, plots 2 x 10 ft. were replicated 2 or 4 times and the transplants were set in commercial fields in single 75 to 100 ft. rows for each treatment replicate. In simulated commercial trials, non-replicated treatment plots 2 x 40 ft. with an adjacent paired control were installed in seedbeds on 7 farms. Seedlings were transplanted in commercial celery fields at each location in single 90 to 100 ft. rows per treatment.

Field experiments. Primary evaluations were based on duplicate or triplicate 6 ft. row segments. The usual plot size for secondary evaluation was single 25 to 30 ft. rows replicated 4 or 5 times. At the tertiary level, plots 5 rows wide and 35 to 50 ft. long were replicated 4 or 5 times. Simulated commercial field plots 5 or 6 rows wide by ½ mile long were installed on 8 farms. Full commercial trial plots 24 rows wide by ½ mile long were not replicated.

Experimental design: Randomized block designs were used in secondary and tertiary evaluations and the data were analyzed by analysis of variance procedures. In simulated commercial experiments each location was used as a replicate in analysis of variance procedures.

Celery varieties: Seedbed evaluations included: P.P. Volante, 162 and 52-70H. Simulated commercial seedbed trials comprised 52-70 and 52-70H. The horticultural varieties in secondary and tertiary field evaluations were: Emerald (EES 148), Waltham, 52-70 and 259-19. All commercial trials were installed in fields of Emerald, D-5, Golden, 52-70 and 52-70H.

Time of application: In seedbeds, celery ranged from the cotyledonary leaf stage to seedlings with 1, 2, 3, 4 or 5 true leaves. Field trials were initiated 2 to 5 weeks after setting of commercial celery transplants.

Annual grass seedlings ranged from 1 to 5 in. tall and broadleaf weeds to approximately 6 in. tall in seedbed trials. Weed growth frequently was more advanced in field trials.

Experiments during the two-year evaluation period were initiated throughout the crop year from early fall to late spring.

Response data: Seedbed. Celery seedling stand counts were made after herbicide application and seedling plant weight was recorded at setting at some locations. Visual observations of celery response were made periodically. Weed control effectiveness was determined by weed counts or visual ratings and weed species response was noted.

Field. Celery plant tolerance and weed control were evaluated visually. Celery plant height and time required for handweeding were recorded in one experiment.

Harvest data: Seedbed and field. Number of petioles and length of the two outermost petioles per plant were obtained from 15 randomly chosen, fresh-trimmed marketable plants per plot. Marketable plants conformed to "U.S. Extra No. 1" grade standards and were in the size range of 2 to 8 dozen stalks per Howard crate. Relative crates per acre yields were calculated on this basis.

Seedbed. Thirty to 45 ft. of row were sampled in secondary seedbed evaluations and the data included number and length of petioles per plant, and number, weight and size distribution of marketable plants. Samples for simulated commercial trials were single rows 50 ft. long and the data comprised number, weight and size distribution of marketable plants.

Field. Primary evaluation plots were not harvested. Secondary and tertiary trial data were number and length of petioles, and number, weight and size distribution of marketable plants; samples for each treatment replicate were 25 to 66 ft. of row. Five to 6 sub-samples 30 ft. long were obtained per treatment at random throughout the simulated commercial trials; the number, weight and size distribution data for marketable plants are based on this total of 150 to 180 ft. of row per farm installation. In commercial trials complete plots were machine harvested and packed and the number of crates of each size recorded.

Quality evaluation: The exterior quality of celery was evaluated by the plant measurement and yield data. Objective or organoleptic evaluations of the influence of "Karsil" treatment on interior celery quality were not made regularly. Plants were observed for visible appearance and were tasted for off-flavor by the author at each harvest.

Residue sampling: Celery samples for residue analysis were taken periodically, and especially at harvest, in 9 experiments and sub-

mitted for residue determinations by the research laboratories of the Niagara Chemical Division at Baltimore, Maryland, and Middleport, New York.

Experimental Results

Primary evaluation trials: "Karsil" at 1¼ lb/A effectively controlled seedbed weeds but reduced stand slightly and temporarily stunted celery seedlings. Golden, Summer Pascal, and Utah celery types were especially tolerant of "Karsil" applied at 3 or 4 weeks after transplanting. Control of emerged annual grass and broadleaf weeds was essentially complete at rates of 5 or 6 lb/A.

Seedbed experiments: In secondary evaluation trials, only two replications were brought to harvest at each of two locations. "Karsil" (1 or 2 lb/A) stunted celery seedlings but seedling stand did not differ significantly from controls when the herbicide was applied at the

Table 1. Average celery plant response to post-emergence herbicidal treatments to seedbeds at 5 locations (52-70 and 52-70E).

		Data for Marketable Plants at Field Harvest				
Herbicide Treatment	Fresh weight (100 transplants)	Petioles per plant	Petiole length	Plants per plot	Weight per plot	Relative crates/Acre
KARSIL, 1 lb/A	150 gm	9.2	25.2 cm	68	90 lb	637
Paired check	150	9.8	25.6	66	95	577
KARSIL, 2 lb/A	150	10.1	24.6	71	98	674
Paired check	136	10.1	25.3	67	110	673
KARSIL, 3 lb/A	162	10.4	25.1	69	107	699
Paired check	155	10.2	25.5	75	110	697
KARSIL, 1 lb/A + VEGADEX, 3 lb/A	158	9.6	25.1	68	97	670
Paired check	143	9.5	24.5	72	104	662

Tabl 2. Average celery and annual weed response following post-emergence herbicidal treatments in transplanted celery (Emerald).

Herbicide treatment	Celery tolerance	Grass weed control	Broadleaf weed control
Handweeded control	100 %	100 %	100 %
KARSIL, 3 lb/A	94	97	97
4	91*	94	94
5	81**	97	100
KARSIL, 3 lb/A + VEGADEX, 3 lb/A	84**	97	100
Mineral spirits, 60 gpa	94	81*	81**
Mineral spirits, 60 gpa + VEGADEX, 3 lb/A	91*	87	94

* Treatments significantly different from handweeded.
** Treatments highly significantly different from handweeded.

2 to 3 true leaf stage. Control of broadleaf weeds was practically complete at both application rates. Celery plant appearance, size and weight did not appear to differ among the chemical treatments and controls at transplanting. At field maturity, the number of petioles per plant did not differ among the treatments and controls. Outer petiole length was reduced slightly (10%) in plants sprayed at the cotyledonary leaf stage but petiole length was not affected in plants sprayed at the 2 to 3 leaf stage. Seedbed treatment did not affect number or weight of marketable plants per plot. Celery size distribution did not appear to differ among the treatments. The addition of "Vegadex" at 2 lb/A to "Karsil" did not alter the above results.

In simulated commercial seedbed trials at 7 locations, "Karsil" alone or in combination with "Vegadex" provided commercially adequate to complete weed control. Stand of seedling celery (52-70 or 52-70H) was reduced slightly and seedlings were stunted temporarily by the higher rates of "Karsil," 2 or 3 lb/A. Transplants from the herbicide plots frequently were slightly, but not significantly, heavier than from the paired controls when set in the field. Neither number or length of petioles, number or weight of marketable plants per plot, or relative crates per acre yield differed significantly between treated plots and their paired controls. This was true, also, among rates of "Karsil" application. The greatest differences were among locations

Table 3. Average harvest data for fresh-trimmed marketable celery (Emerald) following post-emergence herbicidal treatments to transplants.

Herbicide treatment	Number petioles	Length petioles	Plants per plot	Weight per plot	Relative crates/A
Handweeded control	10.4	23.6 cm	51	59 lb	950
KARSIL, 3 lb/A	10.2	23.9	51	52	908
4	10.4	23.9	50	56	905
5	10.0	24.1	52	56	933
KARSIL, 3 lb/A + VEGADEX, 3 lb/A	10.0	24.9	53	57	975
Mineral spirits, 60 gpa	10.4	23.6	51	58	974
Mineral spirits, 60 gpa + VEGADEX, 3 lb/A	9.6	23.6	52	59	933

Table 4. Average celery (52-70) and weed response to post-emergence herbicides in transplanted celery.

			Data for Marketable Plants at Field Harvest				
Herbicide Treatment	Sedge control	Celery tolerance	Petioles per plant	Petiole length	Plants per plot	Weight per plot	Relative crates/A
Handweeded	100 %	100 %	10.5	29.2 cm	83	142 lb	1048
KARSIL, 3.2 lb/A	100	100	9.7	27.5	79	127	963
4.8	100	97	9.7	27.7	79	142	976
6.4	100	87	10.2	27.7	79	145	1054
KARSIL, 4.8 lb/A + VEGADEX, 4.8 lb/A	100	97	10.5	27.7	80	140	1027
Mineral spirits, 50 gpa	78	100	10.2	28.7	79	132	957
Mineral spirits, 50 gpa + VEGADEX, 4.8 lb/A	81	100	11.2	28.5	76	138	962

rather than among treatments. These data are summarized in Table 1.

Field experiments: The first of the secondary evaluation experiments in 1958 was installed and grown under adverse late spring conditions. Tolerance of Emerald celery to 1, 3 or 6 lb/A of "Karsil" was excellent. Annual grass weed control was commercially adequate at 3 lb/A and was essentially complete at 6 lb/A. Broadleaf weeds were controlled completely at all three rates. Plant data at harvest (number or length of petioles or fresh-weight of trimmed celery) did not differ significantly among the Karsil treatments and the handweeded control.

Data from a second experiment with the same variety in the fall of 1958 are summarized in Table 2 and Table 3. Celery plant tolerance was reduced significantly at the highest "Karsil" rates and in combinations with "Vegadex." "Karsil" treatments were superior to mineral spirits, alone or with added "Vegadex," in the control of annual grass and broadleaf weeds. At harvest, the treatments did not differ significantly in respect to number or length of petioles, number or fresh-trimmed weight of marketable plants or relative crates per acre yield.

In one tertiary evaluation experiment the treatments did not significantly injure 52-70 celery. Control of sedges, *Cyperus* spp. and *Kyllinga* sp., was essentially complete with all rates or combinations of "Karsil." The herbicidal treatments did not significantly affect number or length of petioles or number or weight of marketable plants or relative crates per acre yield (Table 4).

Table 5. Average celery (259-19) transplant and annual weed response to post-emergence herbicides.

Herbicide treatment	Celery tolerance	Plant height	Grass weed control	Broadleaf weed control	Minutes to hand weed
Handweeded	100 %	40.7 cm	100 %	100 %	35.2
KARSIL, 3 lb/A	97	33.5**	72**	78**	17.7**
4	100	34.2**	81**	94	16.0**
KARSIL, 3 lb/A + VEGADEX, 3 lb/A	87*	33.2**	94*	97	13.0**
Mineral spirits, 50 gpa	100	36.5*	75**	25**	30.5

* Treatments significantly different from handweeded.
** Treatments highly significantly different from handweeded.

N.B. Celery tolerance was rated at 2 weeks after spraying and plant height measurements were made at 1 month after spraying.
Handweeding records were taken 2 weeks after weed control was rated.

Table 6. Average harvest data for fresh-trimmed marketable celery (259-19) after applying post-emergence herbicides to transplants.

Herbicide treatment	Petioles per plant	Petiole length	Plants per plot	Weight per plot	Relative crates/A
Handweeded	7.5	22.2 cm	122	154 lb	793
KARSIL, 3 lb/A	7.9	22.1	116	156	821
4	7.6	22.4	118	145	775
KARSIL, 3 lb/A + VEGADEX, 3 lb/A	8.0	22.9	118	157	797
Mineral spirits, 50 gpa	7.6	22.7	114	155	791

Celery was injured significantly by the "Karsil" + "Vegadex" mixture in later tertiary evaluation. All herbicidal treatments retarded growth of 259-19 celery measurably and significantly at one month after application. Growth reduction from mineral spirits was slight. Large annual grass and broadleaf weeds present at application in this trial were not controlled as well as in other experiments. Herbicidal treatments other than mineral spirits were handweeded subsequently in highly significantly less time than the handweeded control (Table 5). The influence of herbicidal treatment on early plant size was not reflected in the marketable characteristics of the crop. Differences among herbicide treatments were not significant in respect to: number or length of petioles number or fresh weight of marketable plants or relative crates per acre yield (Table 6).

In simulated commercial trials, single large plots (½ to 1 acre) of "Karsil" and "Karsil" + "Vegadex" were compared against adjacent cultivated and weeded controls in commercial celery fields at 8 locations. Although 52-70 and 52-70H were the main varieties used, Emerald, D-5 and Golden celery were included at one location each. Weeds were larger and more vigorous at many of these locations than in earlier trials. Stooling plants, among annual grasses especially, were difficult to control. The average performance of "Karsil" and its combination with "Vegadex" was commercially acceptable or better. Frequently, slight celery plant stunting and chloronemia developed soon after application, but could not be detected 4 to 6 weeks later. Chemical treatments, at 6 locations harvested, did not differ significantly from the cultivated controls in number or weight of marketable celery nor in relative crates per acre yield. Relative yields per acre were: "Karsil," 585 crates; "Karsil" + "Vegadex," 581 crates; and control, 628 crates.

Commercial scale post-emergence "Karsil" treatments were applied to 3.1 acre plots for machine harvest in two fields of 52-70 celery. Treatments were compared on the basis of size distribution of crates of machine-packed celery. Differences among the herbicidal treatments in total crates per acre yield were slight; the greatest differences were in the sizes packed. Generally, treatments including "Karsil" produced fewer crates of the larger plant sizes (e.g., 2 dozen stalks per crate) and more crates of the smaller plant sizes (e.g., 4 dozen stalks per crate). The total yields and differences in proportion of the sizes packed for the two fields are illustrated in Figure 1 and Figure 2.

Herbicide residue data[5]: Chemical residues were not detectable in marketable celery plants 5 months after "Karsil" was applied at 6 lb/A. Uncorrected residues of 0.15 and 0.83 ppm were determined at three weeks after spraying transplants with "Karsil" at 1 and 5 lb/A, respectively. Samples from subsequent secondary and tertiary evaluation trials with "Karsil" rates up to 6.4 lb/A were analyzed with the following results: residue levels approximated 0.05 ppm at 42 days after application; residues were 0.05 ppm or less at 62 and 84 days after spraying. Data from residue samples taken at 10-day intervals in the commercial

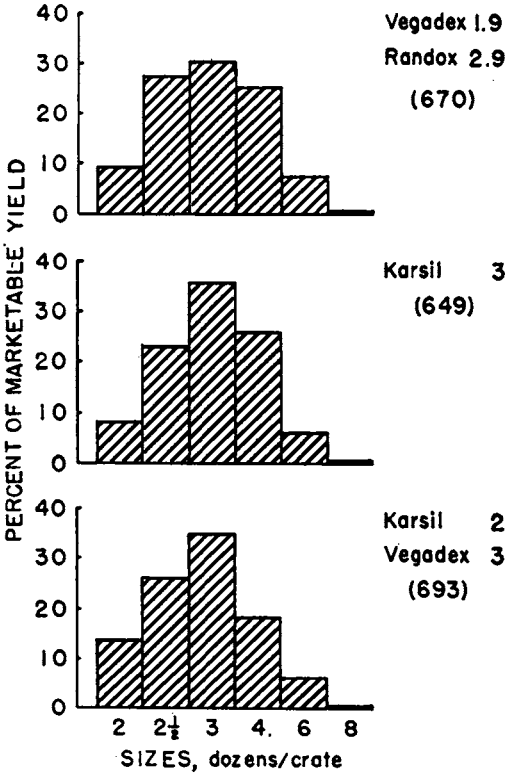

Fig. 1. Size distribution of marketable yield of celery (52-70). "Karsil," 3 lb/A, and "Karsil" + "Vegadex," 2 + 3 lb/A, applied post emergence are compared with "Vegadex" + "Randox" applied pre-emergence at setting. Values in parentheses ( ) are total crates per acre yields in machine harvested and packed commercial trials.

[5]Niagara Chemical Division. 1958. Personal communication, Carroll D. Applewhite. 1959. Personal communication, Carroll D. Applewhite. 1960. Personal communication, Jack R. Graham.

"Karsil" experiment are illustrated in Figure 3, where "A" represents a semi-logarithmic regression of the data and "B" an arithmetic regression. Both depict the rapid decline from 40.8 ppm recovery immediately after spraying to 0.05 ppm 50 days later.

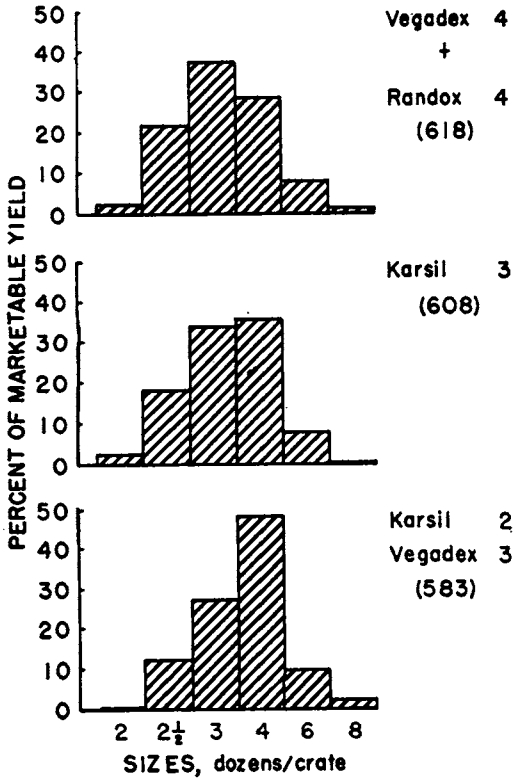

Fig. 2. Size distribution of marketable yield of celery (52-70). "Karsil," 3 lb/A, and "Karsil" + "Vegadex," 2 + 3 lb/A, applied post emergence are compared with "Vegadex," 4 lb/A, at setting plus "Randox," 4 lb/A, post emergence. Values in parentheses ( ) are total crates per acre yields in machine harvested and packed commercial trials.

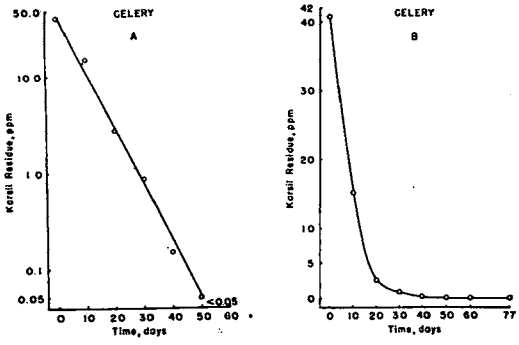

Fig. 3. Recovery of "Karsil" residue at 10-day intervals following application of 3 lb/A post emergence to celery (52-70) and weeds. "A" represents a semi-logarithmic regression of the data and "B" an arithmetic regression.

Discussion

"Karsil" effectively controlled seedling plants of a wide range of annual grass and broadleaf weed species (Table 7) when applied post-emergence in celery seedbeds and fields. An *Umbellifereae, Ptilimnium capillaceum* (Michx) Raf., was controlled only when very young. Annual grass weeds with 4 or 5 leaves and up to 5 or 6 in. tall were controlled readily. After tillering, grass weeds required increased rates for effective control. Annual broadleaf weeds 6 to 8 in. tall were controlled easily. "Karsil" rates of 1 to 3 lb/A in seedbeds and 3 or 4 lb/A in fields were sufficient. Weed control was not apparent immediately after spraying; generally, an interval of 5 to 10 days was required before accurate assessment of control could be made. Residual weed control with "Karsil" was brief after post-emergence spraying. The addition of "Vegadex" prolonged pre-emergence residual weed control in combination treatments.

Celery seedlings in the cotyledonary leaf stage were most susceptible to stunting. Seedling tolerance increased with increasing numbers of true leaves and injury increased with increasing rates of "Karsil." Temporary stunting persisted for 3 to 4 weeks after application. Seedling stand reduction was slight regardless of stage of plant development at application.

Slight, temporary stunting usually accompanied application of "Karsil" to established transplants. Plant recovery was complete in 3 to 4 weeks time at most locations. Occasionally, treated transplants developed a temporary chloronemia of sprayed expanded and unexpanded leaves. Recovery of normal color was more rapid than recovery from stunting.

"Karsil" treatment did not appear to influence foliar or other disease susceptibilty under the commercial pesticide spray programs of the cooperating growers.

Despite early stunting of seedlings and transplants, number of petioles per plant, length of outer petioles, and number and weight of marketable plants per plot were not adversely affected by "Karsil." Relative crates per acre yields were reduced slightly, but not signi-

ficantly, in some instances with transplants in simulated commercial and commercial field trials. This diminution was related to a slight decrease in large plant sizes and a corresponding increase in smaller plant sizes and appeared to result from an estimated 4 to 5-day delay in maturity in "Karsil" plots. However, this hypothesis was not supported in unreported seedbed and field time-of-harvest trials under late spring conditions.

The interior quality of celery did not appear to be affected by "Karsil." An informal panel of three men failed to consistently differentiate among samples at one harvest. Off-flavors or other undesirable characteristics were not detected by the author during harvests of the experiments.

"Karsil" residues recovered from fresh-trimmed marketable plants at normal, mature harvest were barely detectable (0.05 ppm or less). The rapid decline of residues could be attributed in part to dilution by increased plant material and weight with growth. Normal chemical degradation would account for an additional loss of chemical. Also, the petioles originally sprayed were removed from the plant by natural physiological trimming which accompanied petiole senescence. Further, limited, residue removal probably occurred at harvest when celery was trimmed to meet the market pack. The recovery of slight residues from petioles at harvest indicated translocation of the herbicide from petioles originally sprayed. The residue level recovered in these investigations would appear to be safe and not sufficient to preclude "Karsil" use for post-emergence weed control in celery. The manufacturer does not plan registration at the present time.

"Karsil" would be recommendable for post-emergence weed control in celery in the Florida Everglades upon label clearance and commercial availability.

Summary

"Karsil," N-(3,4-dichlorophenyl)-2-methylpentanamide, afforded exceptional control of emerged annual grass and broadleaf weed seedlings in celery on organic soil in primary, secondary, tertiary and commercial evaluations over a two-year period. Few weed species were resistant when young. Dosage required for control ranged from 1 to 4 lb/A and increased as weed seedling development advanced.

Table 7. Annual weed species normally controlled in the seedling stage by "Karsil."

Scientific Name	Common name
Digitaria sanguinalis (L.) Scop.	crabgrass
Eleusine indica (L.) Gaertn.	goosegrass
Acnida cannabina L.	carelessweed
Amaranthus spinosus L.	spiny amaranth (stickerweed)
Ambrosia sp.	ragweed
Chenopodium sp.	lambsquarters (Mexicantea, goosefoot)
Eclipta alba (L.) Hassk.	none
Eupatorium sp.	dog fennel, boneset
Galinsoga ciliata (Raf.) Blake	hairy galinsoga
Galium sp.	bedstraw
Gnaphalium spathulatum Lam.	cudweed
Parietaria floridiana Nutt.	pellitoryweed
Portulaca oleracea L.	purslane
Rorippa sp.	yellow cress
Cyperus Iria L.	none
C. odoratus L.	none
C. rotundus	purple nutsedge
Kyllinga sp.	watergrass (water sedge)

Celery stand was not affected, but seedlings were stunted temporarily when "Karsil" was applied to seedbeds. Seedlings were relatively tolerant to rates up to 3 lb/A, especially after three true-leaves developed. *Plants* sprayed in seedbeds and grown to harvest did not differ from controls in plant characteristics or yield.

"Karsil" frequently induced temporary chloronemia and stunting in field transplants when applied at herbicidal rates. Plants recovered rapidly from this initial growth retardation and did not differ from controls in plant characteristics or yield at time of normal harvest.

The addition of "Vegadex" did not influence "Karsil" performance.

Residues of "Karsil" in fresh-trimmed marketable celery at harvest were barely detectable (0.05 ppm or less) and should not preclude safe use of this herbicide. "Karsil" would be recommended, upon acceptable labelling and commercial availability, for control of emerged weeds in celery seedbeds and fields in the Florida Everglades.

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