PERFORMANCE OF SUCKER CONTROL MATERIAL ON AGRONOMIC AND CHEMICAL QUALITY OF FLUE-CURED TOBACCO

By Nestor Rosa and C.W.H. Caughill[1]

The materials currently used for the control of axillary buds in Canada are formulations of either n-decanol or mixtures of n-octanol and n-decanol. The recommended applications to flue-cured tobacco are at the elongated bud stage of development and approximately one week later. A four-year study showed that yield was generally increased by approximately 100 kg/ha and monetary returns by $420/ha, and sucker numbers and weights were significantly reduced, with two applications as compared to a single application of either n-decanol or mixtures of n-octanol and n-decanol. Most agronomic parameters, such as total alkaloids, reducing sugars, lamina weight, grade index, and leaf dimensions, were not significantly affected by the contact sucker control materials.

Additional key words: Sucker control, application rate, axillary buds, total alkaloids, reducing sugars, *Nicotiana tabacum*.

INTRODUCTION

The sucker control chemicals currently recommended for use on flue-cured tobacco in Canada include those based upon either n-decanol or a mixture of n-octanol and n-decanol, and since the early '70s, these are the most commonly used materials for the control of axillary buds, or suckers. Cultural practices, cultivars, harvesting, and curing procedures have been altered over the years to maximize the production of flue-cured tobacco (6) and provide effective materials for the control of axillary buds in tobacco. Effective control of suckers has been shown to increase yield and substantially improve quality (4). Although maleic hydrazide continues to be widely used as a systemic growth regulator in more temperate areas, its use in Canada is regulated through discount pricing because of the detrimental effects on quality under our climatic conditions (1). Systemic sucker control chemicals leave a residue in the leaf, adding to the total pesticide load of the leaf. Contact fatty alcohol sucker control chemicals provide minimal residues (7) since these materials are similar to naturally occurring plant constituents. The following is a summary of the current status of sucker control materials used in Canada and their effect on major agronomic and chemical characteristics of flue-cured tobacco.

MATERIALS AND METHODS

Seedlings of *Nicotiana tabacum* L., cv. Delhi 76, were propagated in an unheated greenhouse to transplant size as per recommendations (6). Field plots were generally planted during the last week of May when threats of freezing conditions were minimal and soil temperatures were approximately 20° C or greater. One row plots were 24.4 × 1.2m wide with an interplant distance of 0.61m. Alternate rows were not harvested to provide a guard row between treatments. Sucker control materials were applied to treatment rows according to manufacturers' recommendations. The sucker control program on guard rows maintained sucker growth at levels similar to treatment rows. Materials were mixed in water (450 L/ha) and applied as a coarse spray at low pressure (100 kPa), directed at the top-third of the plant. The excess liquid ran down the stalk to contact the axillary buds and caused a "chemical burn" to the axillary buds along the entire length of the stalk. All sucker control materials were formulations of n-decanol except for Emtrol, which was a mixture of n-octanol and n-decanol. For the n-decanol materials, the application rates were 16.8 L/ha at elongated bud stage of growth and 19.6 L/ha applied 7 days later. The initial rate for Emtrol was 19.6 L/ha and 22.0 L/ha for the second application rate. The field plot design was a four replicate, two factor, factorial design with the number of applications as the main factor and the chemicals, the second. The crop was harvested in five primings based on a schedule dictated by crop maturation and growing conditions. Harvested leaves were tied to lathes and cured in standard down-draft or in bulk kilns. The cured leaves were graded and sampled for chemical analyses. The following parameters were determined: leaf dimensions, sucker number and weights, green leaf weight, and yield, grade index, return, total alkaloids, and reducing sugars (2) of the cured leaf. Lamina weight (8) and filling values (Horseman, A., and C.F. Sharman, Tobacco Chemists' Research Conference, Duke University, Durham, NC 1958: 13) were determined for specific years only.

RESULTS AND DISCUSSION

Table 1 summarizes the yield data for the four-year period of 1985 to 1988. The main plot effect showed that dual applications of the contact sucker control materials provided significantly higher yields in two of four years and that for all years the average yield increase was higher by 3.6%, or approximately 100 kg/ha, for the dual treatment. Significant differences in yield among the chemicals evaluated were recorded for only one year (1986). Simple comparisons show that chemical sucker control outyielded hand-suck

Table 1. Performance of flue-cured tobacco yield based on single and dual application of fatty alcohol sucker control chemicals.

	1985	1986	1987	1988	Average	SE[a]
			kg/ha			
Single application[b]	2703	2867 b[e]	3311	2937 b	2954	111
Dual application	2793	3040 a	3361	3048 a	3060	101
Chiptac[c]	2805	2841 b	3321	3100	3017	105
Delete	2774	2983 a	3308	3044	3027	95
Emtrol Ten	2762	3038 a	3369	2981	3038	109
Pfizol-10	2758	2982 a	3316	2899	2989	103
Emtrol	2654	2923 ab	3365	2998	2985	127
TNS[d]	2519	2346	2824	2598	2572	86
HS	2608	2736	3063	2697	2776	86

[a] Standard error of the means.
[b] For application rates see text.
[c] Registered sucker control materials.
[d] TNS = topped but not suckered; HS = hand suckered twice. Data for TNS and HS were not included in statistical analyses but shown here for comparisons only.
[e] Means (columns) followed by the same letter are not significantly different at P = 0.05 as determined by Duncan's multiple range test.

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ered plots by about 240 kg/ha and the topped, not suckered tobacco by approximately 440 kg/ha. The increased yields through topping and sucker removal were described by Elliot (2) and Rosa (4), and further indicated that plants maintained in the vegetative stage of growth direct more photosynthate into actively growing leaves which results in increased yields. The sucker control materials provide long term control of axillary bud or sucker growth and maintain the plant in a vegetative growth stage to provide the potential for increased yield.

Grade indices (**Table 4**) were not significantly different for any of the four years, therefore monetary returns (**Table 2**) tended to parallel the yield effects. Return per hectare was only higher in two of four years for the dual applications and only for one of four years for the various treatments (**Table 2**). Current trials did not show the positive effects reported previously (3). Lamina weight, a measure of leaf density, was not affected by either the number of applications of sucker control materials, or by the materials themselves (**Table 5**). **Table 3** summarizes the effect of sucker control materials on sucker numbers and weights. Except for 1985, the dual application of sucker control materials resulted in significantly reduced number and weight of suckers. The different materials responded differently with years, with the exception of 1985, where differences were not significant. Excellent control of sucker growth was maintained throughout the harvesting season when materials were applied at the bud elongation stage of growth development and approximately one week later.

The efficacy of individual sucker control materials tended to vary among candidates. If any trends can be assumed, one could suggest that the n-decanol materials were marginally better than the mixture of n-octanol and n-decanol; however, such comparisons would require more study. Visual observations have indicated that the efficacy of these two types may be dependent upon the season, and in general they provide the same level of control. Leaf length and leaf width of the top three leaves (tip leaves) were not affected by either dual application of the sucker control materials or the materials used (**Table 4**). Consequently, the leaf areas were similar. Although it was reported by Rosa (3) that there was a marginal response of leaf dimensions during the early trials of the fatty alcohol type materials, the current study did not show this effect. **Table 5** summarizes the effect of the sucker control treatments upon total alkaloids and reducing sugars, again indicating that these parameters were not affected by the treatment materials used.

Table 2. The effect of times of application of sucker control materials on the return index of flue-cured tobacco.

	1985	1986	1987	1988	Average	SE[a]
			$/ha			
Single application[b]	9778	10764 b[e]	12989	11419 b	11238	583
Dual application	10080	11431 a	13247	11839 a	11649	564
Chiptac[c]	10152	10626 b	13138	12011	11482	586
Delete	9893	11225 a	13030	11905	11513	568
Emtrol Ten	10230	11403 a	13143	11548	11581	518
Pfizol-10	9889	11227 a	13122	11290	11382	575
Emtrol	9782	11007 ab	13159	11685	11408	610
TNS[d]	8991	8710	10710	9988	9600	399
HS	9297	10236	12082	10368	10496	502

[a] Standard error of the means.
[b] For application rates see text.
[c] Registered sucker control materials.
[d] TNS = topped but not suckered; HS = hand suckered twice. Data for TNS and HS were not included in statistical analyses but shown here for comparisons only.
[e] Means (columns) followed by the same letter are not significantly different at P = 0.05 as determined by Duncan's multiple range test.

Table 3. The effect of times of application and sucker control materials on the number and weight of axillary buds or suckers.

	1985	1986	1987	1988	Average	SE[a]
			No. of suckers/plant			
Single application[b]	1.3	1.5 a[e]	1.4 a	2.5 a	1.7	0.24
Dual application	1.0	0.9 b	0.7 b	1.0 b	0.9	0.06
Chiptac[c]	1.1	2.0 a	0.6 b	1.1	1.2	0.25
Delete	1.4	1.0 bc	0.6 b	0.5	0.9	0.18
Emtrol Ten	1.0	0.8 c	1.1 ab	0.9	1.0	0.06
Pfizol-10	1.1	0.8 c	1.2 ab	1.7	1.2	0.16
Emtrol	1.2	1.3 b	1.6 a	1.8	1.5	0.12
TNS[d]	6.7	9.1	9.4	7.5	8.2	0.56
HS	12.2	11.7	17.6	14.5	14.0	1.17
			Fresh weight (g) of suckers/plant			
Single application	117	208 a	235 a	77 a	159	32
Dual application	77	76 b	105 b	33 b	73	13
Chiptac	127	250 a	101 b	38 ab	129	38
Delete	89	105 bc	106 b	11 b	78	20
Emtrol Ten	60	132 b	205 a	38 ab	109	33
Pfizol-10	97	54 c	193 ab	41 ab	96	30
Emtrol	96	170 b	246 a	48 ab	140	38
TNS	713	507	481	382	521	60
HS	242	217	172	186	204	14

[a] Standard error of the means.
[b] For application rates see text.
[c] Registered sucker control materials.
[d] TNS = topped but not suckered; HS = hand suckered twice. Data for TNS and HS were not included in statistical analyses but shown here for comparisons only.
[e] Means (columns) followed by the same letter are not significantly different at P = 0.05 as determined by Duncan's multiple range test.

Table 4. Average values for the 3-year period, 1986-1988, for leaf length and width, leaf area, and grade index.

	Length	Width	Area	Grade Index[a]
	cm	cm	cm^2	¢/kg
Single application[b]	56.6	26.3	1014	379.6
Dual application	56.6	26.1	1008	379.9
Chiptac[c]	56.8	26.1	1009	380.0
Delete	56.7	26.1	1010	379.3
Emtrol Ten	56.6	26.2	1002	380.7
Pfizol-10	56.1	26.0	997	380.3
Emtrol	56.9	26.3	1023	381.6
TNS[d]	56.4	26.1	1004	372.8
HS	56.4	26.0	997	377.1

[a] Four-year average, 1985-1988.
[b] For application rates see text.
[c] Registered sucker control materials.
[d] TNS = topped but not suckered; HS = hand suckered twice. Data for TNS and HS were not included in statistical analyses but shown here for comparisons only.

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Table 5. **The response of total alkaloids, reducing sugars, and lamina weight to five sucker control materials.**

	Total Alkaloids	Reducing Sugars	Lamina Wt.[a]
	------ % ------		g/cc
Single application[b]	2.47	18.1	7.060
Dual application	2.46	18.5	7.133
Chiptac[c]	2.48	18.1	7.383
Delete	2.48	16.1	7.461
Emtrol Ten	2.48	17.9	7.339
Pfizol-10	2.48	18.7	7.457
Emtrol	2.45	18.4	7.377
TNS[d]	2.48	17.7	6.821
HS	2.49	17.9	7.127

[a] Three-year average, 1986-1988.
[b] For application rates see text.
[c] Registered sucker control materials.
[d] TNS = topped but not suckered; HS = hand suckered twice. Data for TNS and HS were not included in statistical analyses but shown here for comparisons only.

During the period 1967 to 1976, the use of fatty alcohols as sucker control materials appeared to decrease total alkaloid levels, particularly in the upper part of the plant (3), but tended to increase reducing sugars levels. One could speculate that current agronomic and cultural practices may be responsible for the elimination of any deleterious effects of the sucker control materials on certain chemical parameters.

It has been suggested that tobacco coming from plants on which suckers were controlled through the use of MH differed from the controls in total alkaloids, reducing sugars, total ash, equilibrium moisture, and filling capacity (5). The success of the fatty alcohols in controlling the growth and development of axillary buds of tobacco may be related to the short growing season. Tobacco generally requires a five- to six-week harvest period. The contact materials, when applied twice, provide season long control. The contact materials have a negligible impact upon overall pesticide load on the cured tobacco since the fatty alcohols leave little residue (7).

A further consideration for the use of fatty alcohols under climatic conditions in southwestern Ontario continues to be the rate at which axillary bud development occurs after the terminal bud is topped. Unless the axillary bud growth is restricted within days, they quickly become too advanced to control by any type of chemical, making manual removal necessary.

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