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EVALUATION OF THE PHYSICAL, CHEMICAL AND  
SMOKING PROPERTIES OF TOBACCO TREATED  
WITH CHEMICALS TO CONTROL WEATHER FLECK  
GROWN ON THE I. T. CO. FARM - 1961 CROP

Research Laboratory Report No. 53  
IMPERIAL TOBACCO CO. OF CANADA, LTD.

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IMPERIAL TOBACCO COMPANY OF CANADA, LTD.  
RESEARCH LABORATORY  
MONTREAL

EVALUATION OF THE PHYSICAL, CHEMICAL AND SMOKING PROPERTIES  
OF TOBACCO TREATED WITH CHEMICALS TO CONTROL WEATHER FLECK -  
GROWN ON THE IMPERIAL TOBACCO CO. FARM - 1961 CROP

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#### ABSTRACT

An experiment was conducted in 1961 at the Imperial Tobacco Company Practical Experimental Farm to assess the effectiveness of various chemicals in the control of weather fleck and to determine the effect of these chemicals on the physical, chemical and smoking properties of tobacco. The White Gold variety was chosen for this experiment because of its susceptibility to weather flecking. Representative samples of sands-cutters and leaf-tip grades from each treatment were forwarded to the Montreal Research Laboratory. After further blending of the above components in proportion to yield, the tobacco and cigarettes manufactured therefrom were subjected to numerous physical, chemical and smoking tests. In general, the data obtained at this time would tend to indicate that the spraying of tobacco with Fermate, Dichlone or Maneb to reduce the incidence of weather fleck had no significant detrimental effects on the quality of the tobacco. However, because of the inclination of Dichlone to fix the green colour in the tobacco leaf which has been impossible to remove in curing, this chemical is no longer regarded as acceptable. From a consideration of the laboratory data in combination with the field and curing observations it would appear that Maneb is the preferred chemical to use for this purpose. However, the Department of Agriculture has not recommended thus far the use of any chemical for the control of weather fleck and would prefer to develop and make use of resistant varieties.

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OF TOBACCO TREATED WITH CHEMICALS TO CONTROL WEATHER FLECK -  
GROWN ON THE IMPERIAL TOBACCO CO. FARM - 1961 CROP

References: Memorandum from G. W. Boswall, Research Laboratory, entitled "Proposed Experiments for I.T. Co. Farm in 1961", dated March 17, 1961.

Leaf Plant Experiment No. 33 entitled "Outline of Handling and Test Procedures for Leaf from Chemical Control of Weather Fleck Experiment on I.T. Co. Farm, 1961", dated November 16, 1961.

Memorandum from A. E. Gardner, Aylmer, to Leaf Department, Montreal, entitled "I.L.T.Co. Practical Experimental Farm 1961 Crop Experiments" dated January 8, 1962.

Cigarette Sample Specification Sheet for C-59 Series, dated January 22, 1962.

Memorandum from Research Laboratory to Research and Development Department entitled "The Whole Tar and Nicotine Contents of the Smoke from Four Samples of Tobacco Grown on the I.T.Co. Farm, Three Comprising Tobacco Treated with Different Chemicals for the Control of Weather Fleck and One Control Sample", dated June 27, 1962.

Memorandum entitled "Evaluation of Chemicals for Controlling Weather Fleck - I.T.Co. Experimental Farm, 1961", dated July 4, 1961.

INTRODUCTION

An experiment was set up in 1961 at the Imperial Tobacco Company Practical Experimental Farm to determine the effectiveness of three chemicals, namely Fermate, Dichlone and Maneb, in controlling weather fleck and to assess the modifications in the physical, chemical and smoking properties of tobacco that might result from the application of these control chemicals. Due to its established susceptibility to weather flecking, the White Gold variety was selected for this study. After blending in accordance with laboratory instructions and processing through the Aylmer C & C lines, one hogshead representing a blend of sands & cutters and another typifying the leaf and tip grades for each treatment (and control sample) were forwarded to the Montreal plant where after further processing, the tobacco and cigarettes made therefrom were subjected to an extensive series of chemical, physical and smoking tests.

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Cultural Practices, Curing and Yield Information

The cultural practices employed in the growing of the tobacco on the I.T.Co. farm for the evaluation of chemicals for weather fleck control are outlined in Table I. A total of 2.31 acres of tobacco was grown in three locations for each treatment (including a control). A summary of the bale yields obtained from the various treatments is given below:

| Treatment | Yield (lbs.) |          |                        |                   | Ratio of Sands-Cutter/Leaf-tip Yields |
|-----------|--------------|----------|------------------------|-------------------|---------------------------------------|
|           | Total        | Per Acre | Of Sands-cutters Grade | Of Leaf-Tip Grade |                                       |
| Fermate   | 4132         | 1789     | 1562                   | 2570              | 0.61                                  |
| Dichlone  | 3887         | 1683     | 1133                   | 2754              | 0.41                                  |
| Maneb     | 4048         | 1752     | 1664                   | 2384              | 0.70                                  |
| Control   | 3796         | 1643     | 1469                   | 2327              | 0.63                                  |

It is noteworthy that the chemical treatments produced higher yields in all cases but the most pronounced improvements were obtained with the Fermate and Maneb treatments.

The harvesting and curing details are given in Table II. The yields of individual grades from each treatment are shown in Table III.

Processing at the Aylmer Leaf Plant

The tobacco from each of the four treatments was individually blended to provide one hogshead representative of the sands-cutters grades and one representative of the leaf-tip grades. The grades were blended in proportion to their yield from each priming and kiln. The eight batches of tobacco representing the three treatments and control were processed through the Aylmer C & C lines in a random order in consecutive runs, requiring 8 minutes in each instance. The eight resultant hogsheads of strips were forwarded to the Montreal plant for further processing and subsequent analyses.

The results of tests performed during the processing at Aylmer are given in Table IV.

Processing in Montreal Plant

The eight hogsheads of tobacco as received from Aylmer were subjected to a force-aging process for a period of 28 days at 100°F and 75% R.H. The tobacco in all hogsheads reached ambient temperature after 11 days. The daily temperature recordings provided by thermocouples placed within the hogsheads are given in Table V. The maximum temperatures achieved by the various samples varied from 107°F to 111°F.

After force aging the sands-cutters and leaf-tips, components of each treatment were blended in proportion to their yields. The following weights were combined to provide the final four samples to be evaluated:

| <u>Treatment</u> | <u>Sands-cutters<br/>blend (lbs.)</u> | <u>Leaf-tips<br/>blend (lbs.)</u> |
|------------------|---------------------------------------|-----------------------------------|
| Fermate          | 486                                   | 800                               |
| Dichlone         | 329                                   | 800                               |
| Maneb            | 558                                   | 800                               |
| Control          | 505                                   | 800                               |

The samples were conditioned by passing them through the C.T.C.M., cut at 55 cuts/inch and manufactured into cigarettes in accordance with the Cigarette Sample Specification Sheet dated January 22, 1962.

The data obtained by the Quality Control Department during processing are given in Table VI.

The results of the various physical, chemical and smoking tests conducted in the laboratory are presented in Tables VII - IX.

### RESULTS AND DISCUSSION

#### Physical and Smoking Properties (Tables VI and VII)

##### Screening Test (Table VI)

The distribution of the four tobacco treatments on the various sizes of screens showed no distinct pattern although the Dichlone treated tobacco, particularly the sample taken from the cooler, tended to produce larger proportions of the finer material and smaller amounts of the larger particle sizes than obtained from the other three types.

##### Cigarette Inspection (Table VI)

There was no evidence of defective ends in the manufacture of the experimental cigarettes.

##### Cigarette Stability (Table VI)

The Fermate treated tobacco was slightly superior to the control tobacco and considerably better than the other treated types from the standpoint of end stability. The latter two samples were observed to be equivalent in this respect. However, very little significance is normally attached to differences of the order observed at this time.

##### Filling Capacity (cut tobacco) and Compression (cigarettes) (Table VII)

The L.S.D. for treatment means at the 95% level of significance was calculated to be .06 c.c./2 g. for the filling capacity data under consideration. On the basis of this, the Fermate treated tobacco was on the verge of being significantly poorer than the control tobacco, the Maneb treated tobacco was similar to the control and the Dichlone treated sample was found to be

substantially (0.25 c.c./2 g. or approximately 5%) better than the control type.

Contrary to the usual occurrence, the compression data did not indicate the same trend as the filling capacity results. There was no observed difference in compressibility between the treatments and control tobaccos.

#### Shatterability (Table VII)

The treated tobaccos all exhibited a lesser tendency to shatter than the control sample with the Fermate and Maneb treated tobaccos showing the best resistance to degradation (approximately 10% less fines than from the control).

#### Colour (Table VII)

The differences observed in total colour between the chemically treated samples and the control were barely on the borderline of visual perception (maximum  $\Delta E$  of 0.54 obtained between Dichlone treated and control). Differences of this order could probably be regarded as normal sampling error.

#### Cigarette Rate of Burn (Table VII)

The cigarettes made with the Dichlone treated, Maneb treated and control tobaccos were observed to burn at basically the same rate. The Fermate treated cigarettes burned slightly faster but again the difference would not be considered significant.

#### Cigarette Smoking Test (Table VII)

After subjecting the cigarettes made with the three types of treated tobacco to a "difference" test (versus the untreated tobacco), it was concluded that there was no significant difference in smoking quality between the treatments and the control.

#### Chemical Analysis (Table VIII)

It is rather difficult to provide a comprehensible comparison of three sets of chemical results to a fourth control set. Therefore, we shall simply attempt to point out the highlights of the chemical analyses of these treated tobaccos.

Generally speaking the tobacco treated with Dichlone appeared to deviate to the greatest extent from the control tobacco primarily in its higher  $K_2O$ ,  $P_2O_5$ , total volatile bases and petroleum ether extract levels and lower sugar content. For each of the aforementioned constituents the value obtained for the dichlone treated sample was the extreme value of the four results.

The differences obtained between the treated samples and control for ash, sand & silica, protein nitrogen and total nitrogen were not regarded as significant.

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The MgO levels of the treated samples were consistently lower than the MgO content of the control tobacco while the chloride content of the control was lower than the values obtained for the treated samples.

The nicotine, total alkaloids and total volatile bases contents of the Fermate and Dichlone treated samples were higher than the levels of these constituents in the Maneb treated and control tobaccos. The latter two would be regarded as equivalent with respect to these constituents. The T.V.B. result obtained for the Dichlone treated sample was considerably higher than the other three values.

Similar CaO levels were noted in the Dichlone and Maneb treated tobaccos but these were slightly higher than observed for this constituent in the other two samples.

The P<sub>2</sub>O<sub>5</sub> level in the Dichlone treatment was somewhat higher and the sugars level considerably lower than the respective results obtained for the other three samples. In each of these instances equivalent results were obtained for the samples other than the Dichlone treated.

Similar values of the K<sub>2</sub>O:CaO ratio were calculated for the four samples and these varied slightly around unity. It should be noted that these values are higher than normally encountered with Ontario grown tobaccos and also more desirable than the values usually obtained.

Apart from the low value of 6.2 found for the Total Sugars:Total Alkaloids ratio of the Dichlone treated tobacco, attributable to a low sugar content, the ratios observed for the remaining samples fell within the acceptable range of 8 to 11. The petroleum ether extract levels of the Fermate treated, Maneb treated and control tobaccos were lower than normally encountered while the value provided by the Dichlone treated sample approached a more desirable level.

In summary it may be said that the deviations in the levels of the various constituents noted between the treated samples and control are not of sufficient magnitude to seriously impair the quality of the tobacco.

#### Whole Tar and Nicotine in Smoke (Table IX)

The whole tar and nicotine contents of the smoke from the cigarettes made with the Fermate and Maneb treated tobaccos were found to be very slightly higher than the respective values obtained from the control cigarettes which is reasonable in view of the similarity in the filling capacity and nicotine content of the three types of tobacco and the compressibility and rate of burn of the corresponding cigarettes.

Significantly greater percentages of whole tar and nicotine were obtained in the smoke from the Dichlone treated cigarettes than from the control type. In view of the fact that the nicotine transfer coefficient of these cigarettes was not appreciably higher than the value obtained for the control and that the cigarette compression, pressure drop and rate of burn data were comparable for the two samples, it would appear that the Dichlone treated tobacco had a greater tar producing potential associated with its

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higher nicotine level. The substantially greater filling capacity of the Dichlone treated tobacco was not reflected by any of the tests conducted on the cigarettes and, therefore, it is felt that the circumference of these cigarettes may have been "off" specification.

#### CONCLUSIONS

The data accumulated at this time from a series of chemical, physical and smoking tests tended to indicate that the spraying of tobacco with such chemicals as Fermate, Dichlone and Maneb to reduce the incidence of weather fleck had no significant detrimental effects on the quality of the tobacco. Other than exhibiting a slightly better resistance to shatter, the Maneb and Fermate treated tobaccos were found to be indistinguishable from the control by all of the criteria. The Dichlone treated tobacco deviated from the control to the greatest extent of the three. It possessed significantly superior filling capacity which was possibly attributable to a substantially lower sugar content, significantly different levels of certain chemical constituents and produced cigarettes which yielded higher levels of whole tar and nicotine in the smoke.

According to the field observations made during the summer of 1961 (Table I), Dichlone and Maneb were more effective in controlling weather fleck than was the Fermate treatment. However, in view of the greenish cast that was imparted to many of the Dichlone treated leaves upon curing and the discrepancies that existed between the Dichlone treated and control tobaccos in some of the physical and chemical properties, Maneb would appear to be the preferred chemical to be used in controlling weather fleck. However, the Department of Agriculture has not recommended thus far the use of any chemical for the control of weather fleck and would prefer to develop and make use of resistant varieties.

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TABLE I  
EVALUATION OF CHEMICALS FOR CONTROLLING WEATHER FLECK  
CULTURAL PRACTICES AND FIELD OBSERVATIONS

| Field No.   | Variety    | No. of Acres in Treatment |         |          |       | Dates of          |            |                   |                |                 |                     |                  |
|-------------|------------|---------------------------|---------|----------|-------|-------------------|------------|-------------------|----------------|-----------------|---------------------|------------------|
|             |            | Control                   | Fermate | Dichlone | Maneb | Planting          | Irrigation | Topping           | First Spraying | Second Spraying | First Suckering     | Second Suckering |
| 2a          | White Gold | .57                       | .57     | .57      | .57   | May 30-<br>June 1 | nil        | Aug. 2            | Jul. 28        | Aug. 15         | Aug. 14             | Aug. 3-5         |
| 2b          | White Gold | .87                       | .87     | .87      | .87   | June 5-<br>June 8 | nil        | Aug. 3-<br>Aug. 4 | Jul. 28        | Aug. 15         | Aug. 15-<br>Aug. 16 | Sept. 3-5        |
| 2c          | White Gold | .87                       | .87     | .87      | .87   | June 5-<br>June 8 | nil        | Aug. 3-<br>Aug. 4 | Jul. 28        | Aug. 15         | Aug. 15-<br>Aug. 16 | Sept. 3-5        |
| Total Acres |            | 2.31                      | 2.31    | 2.31     | 2.31  |                   |            |                   |                |                 |                     |                  |

WEATHER FLECK:

The variety, White Gold, selected for this experiment in the use of chemicals for controlling Weather Fleck is highly susceptible to flecking. During the first week in August, Weather Fleck was observed on the Sands and Seconds in these Plots. A careful inspection on August 22nd showed that, while all treatments in this experiment had suffered from Weather Fleck, less damage had occurred in these Plots that had been sprayed. Dichlone and Maneb were particularly effective in reducing the number of damaged leaves that had to be left in the field after the Sands and Seconds were primed.

A very severe outbreak of Flecking occurred on September 10th. At this date only the fifth priming and the tips remained in the field in these Plots. The leaves under the tips on all treatments were affected by this outbreak. The last spraying date was on August 15th, and the sprays had lost their effectiveness by the time that this last outbreak of Weather Fleck occurred.

TABLE II

EVALUATION OF CHEMICALS FOR CONTROLLING WEATHER FLECK  
PRIMING AND CURING DATA

| Date                | Kiln No. | Priming | No. of Sticks |         |          | Curing System | Weather at Harvest | Firing Compl'd | Date    |
|---------------------|----------|---------|---------------|---------|----------|---------------|--------------------|----------------|---------|
|                     |          |         | Control       | Fermate | Dichlone |               |                    |                |         |
| Aug. 10             | 1        | 1       | 115           | 59      | 115      | 129           | TCS-100 Nat. Gas   | Sunny, hot     | Aug. 15 |
| 13                  | 3        | 1       | 85            | 55      | 177      | 324           | Propane            | Cloudy, cool   | 18      |
| 14                  | 4        | 1       | 207           | 323     | 152      |               | Sav-Oil            | Sunny, warm    | 19      |
| 16                  | 6        | 2       | 90            | 77      | 100      | 102           | Oil                | Sunny, warm    | 22      |
| 20                  | 8        | 2       | 196           | 141     | 138      | 140           | TCS-100 Nat. Gas   | Cloudy, cool   | 26      |
| 22                  | 9        | 2       | 83            | 170     | 182      | 175           | Natural Gas        | Cloudy, cool   | 29      |
| 24                  | 11       | 3       | 109           | 111     | 136      | 106           | Sav.-Oil           | Cloudy, warm   | 31      |
| 26                  | 12       | 3       |               |         | 219      | 184           | Oil                | Cloudy, humid  | Sept. 1 |
| 29                  | 13       | 3       | 298           | 323     | 97       | 142           | TCS-100 Nat. Gas   | Cloudy, cool   | 4       |
| 31                  | 15       | 3       |               |         | 88       | 97            | Coal Stoker        | Sunny, warm    | 7       |
| 30                  | 14       | 4       | 90            | 106     | 36       | 159           | Coal Blower        | Cloudy, humid  | 5       |
| Sept. 5             | 18       | 4       | 163           | 158     | 58       | 186           | Sav-Oil            | Sunny, warm    | 12      |
| 7                   | 20       | 4       | 186           | 179     | 162      | 186           | TCS-100 Nat. Gas   | Sunny, warm    | 14      |
| 8                   | 21       | 4       |               |         | 103      | 89            | Coal Blower        | Sunny, warm    | 15      |
| 6                   | 19       | 5       | 87            | 103     | 219      | 142           | Oil                | Sunny, warm    | 13      |
| 11                  | 24       | 5       | 133           | 144     | 172      | 131           | Propane            | Sunny, warm    | 18      |
| 13                  | 25       | 5       | 35            | 166     | 113      | 109           | Sav-Oil            | Sunny, warm    | 20      |
| 14                  | 26       | 5       |               |         | 37       | 163           | Oil                | Cloudy, rain   | 22      |
| 15                  | 27       | 5       | 197           | 121     | 287      | 153           | TCS-100 Nat. Gas   | Cloudy, cool   | 23      |
| 16                  | 28       | 5       |               |         | 95       | 153           | TCS-100 Nat. Gas   | Clear, cool    | 22      |
| 10                  | 23       | 6       | 99            | 121     | 113      | 109           | Nat. Gas           | Sunny, warm    | 17      |
| 18                  | 30       | 6       | 170           | 95      | 287      | 163           | Nat. Gas           | Sunny, cool    | 24      |
| 19                  | 31       | 6       | 126           | 216     | 29       | 153           | Coal Stoker        | Cloudy, cool   | 27      |
| 20                  | 32       | 6       | 29            | 29      | 95       | 153           | Propane            | Cloudy, warm   | 28      |
| Total No. of Sticks |          |         | 2,498         | 2,547   | 2,686    | 2,589         |                    |                |         |

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TABLE III

GRADE YIELD

| Treatment   | Priming | O  | D   | D-2 | X   | X-2 | H   | H-2 | M   | M-2 | E   | E-2 | MF  | MF-2 | R   | R-2 | AF    | AF-2 | BF    | BF-2 | CF  | Total lbs. |     |
|-------------|---------|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|-----|-----|-------|------|-------|------|-----|------------|-----|
| FUNGICIDE   | 1       | 47 | 146 | 39  | 132 | 180 | 223 | 110 | 49  | 45  | 54  | 54  | 205 | 114  | 284 | 115 | 59    | 195  | 21    | 36   | 400 | 513        |     |
|             | 2       |    |     |     |     | 112 | 192 | 277 | 208 | 543 | 58  | 584 |     |      |     |     |       |      |       |      |     | 729        |     |
|             | 3       |    |     |     |     | 104 |     |     |     |     |     |     |     |      |     |     |       |      |       |      |     | 822        |     |
|             | 4       |    |     |     |     |     |     |     |     |     |     |     |     |      |     |     |       |      |       |      |     | 868        |     |
|             | 5       |    |     |     |     |     |     |     |     |     |     |     |     |      |     |     |       |      |       |      |     | 800        |     |
|             | 6       |    |     |     |     |     |     |     |     |     |     |     |     |      |     |     |       |      |       |      |     |            |     |
| Total Yield |         | 47 | 146 | 39  | 132 | 396 | 415 | 387 | 462 | 702 | 699 | 254 | 42  | 256  | 138 | 332 | 3,887 |      |       |      |     | 4,132      |     |
| DICHLONE    | 1       | 42 | 101 | 63  | 34  | 126 | 36  | 36  | 57  | 119 | 400 | 65  | 184 | 35   | 138 | 332 | 3,887 |      |       |      |     | 414        |     |
|             | 2       |    |     |     |     | 61  | 197 | 54  | 214 |     |     |     |     |      |     |     |       |      |       |      |     | 541        |     |
|             | 3       |    |     |     |     | 45  | 126 | 34  |     |     |     |     |     |      |     |     |       |      |       |      |     | 680        |     |
|             | 4       |    |     |     |     |     |     |     |     |     |     |     |     |      |     |     |       |      |       |      |     | 800        |     |
|             | 5       |    |     |     |     |     |     |     |     |     |     |     |     |      |     |     |       |      |       |      |     | 861        |     |
|             | 6       |    |     |     |     |     |     |     |     |     |     |     |     |      |     |     |       |      |       |      |     | 752        |     |
| Total Yield |         | 42 | 101 | 63  | 34  | 106 | 483 | 54  | 250 | 57  | 119 | 984 | 247 | 170  | 451 | 256 | 138   | 332  | 3,887 |      |     | 4,132      |     |
| MANEB       | 1       | 84 | 119 | 102 | 42  | 39  | 163 | 290 | 49  | 52  | 594 | 110 | 110 | 138  | 324 | 93  | 180   | 67   |       |      |     | 414        |     |
|             | 2       |    |     |     |     | 134 | 448 | 46  |     |     |     |     |     |      |     |     |       |      |       |      |     | 541        |     |
|             | 3       |    |     |     |     | 96  |     |     |     |     |     |     |     |      |     |     |       |      |       |      |     | 680        |     |
|             | 4       |    |     |     |     |     |     |     |     |     |     |     |     |      |     |     |       |      |       |      |     | 800        |     |
|             | 5       |    |     |     |     |     |     |     |     |     |     |     |     |      |     |     |       |      |       |      |     | 861        |     |
|             | 6       |    |     |     |     |     |     |     |     |     |     |     |     |      |     |     |       |      |       |      |     | 752        |     |
| Total Yield |         | 84 | 119 | 102 | 42  | 81  | 393 | 738 | 95  | 52  | 642 | 775 | 248 | 379  | 273 | 67  | 4,048 |      |       |      |     | 4,132      |     |
| CONTROL     | 1       |    |     |     |     | 157 | 137 | 81  | 159 | 75  | 112 | 112 | 111 | 111  | 128 | 205 | 205   | 205  | 205   | 205  | 205 | 205        | 411 |
|             | 2       |    |     |     |     | 134 | 227 | 81  | 398 | 349 | 53  | 128 | 75  | 32   | 205 | 205 | 205   | 205  | 205   | 205  | 205 | 205        | 453 |
|             | 3       |    |     |     |     | 170 | 54  | 54  | 151 | 198 | 110 | 231 | 38  | 38   | 38  | 38  | 38    | 38   | 38    | 38   | 38  | 529        |     |
|             | 4       |    |     |     |     |     |     |     |     |     |     |     |     |      |     |     |       |      |       |      |     | 733        |     |
|             | 5       |    |     |     |     |     |     |     |     |     |     |     |     |      |     |     |       |      |       |      |     | 842        |     |
|             | 6       |    |     |     |     |     |     |     |     |     |     |     |     |      |     |     |       |      |       |      |     | 728        |     |
| Total Yield |         |    |     |     | 36  | 159 | 461 | 364 | 135 | 159 | 473 | 611 | 363 | 238  | 306 | 32  | 243   | 61   | 3,796 |      |     | 3,796      |     |

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TABLE IV

RESULTS OF TESTS CONDUCTED DURING PROCESSING AT AYLMER PLANT

One hogshhead was required from a blend of the Sands - Cutters grades and one hogshhead from a blend of leaf - tip grades for each treatment. All of the tobacco produced from each of the four treatments was used in preparing these blends. They were processed in eight consecutive runs on the Aylmer C & C equipment on December 13th, 1961.

| Run No. | Type     | Priming       | Length of Run | Quality Tests (Ave. of two) |                   |            | Moisture Tests (Average of two) |                |      | Leaf Temperature at Condit. Cyl. |
|---------|----------|---------------|---------------|-----------------------------|-------------------|------------|---------------------------------|----------------|------|----------------------------------|
|         |          |               |               | Total % over 1/2"           | Total % Thru 3/4" | Total % VS | Bales Green Strips              | Redried Strips |      |                                  |
| 1       | Maneb    | Sands-Cutters | 8 min.        | 82.3                        | 4.93              | 2.62       | 15.3                            | 17.6           | 12.8 | 144°F                            |
| 2       | Control  | "             | 8 min.        | 79.9                        | 5.39              | 2.43       | 15.7                            | 17.8           | 12.0 | 134                              |
| 3       | Dichlone | "             | 8 min.        | 76.5                        | 7.00              | 2.95       | 15.7                            | 16.8           | 12.8 | 142                              |
| 4       | Feramate | "             | 8 min.        | 79.4                        | 6.25              | 3.77       | 15.5                            | 17.3           | 12.6 | 140                              |
| 5       | Control  | Leaf-Tip      | 8 min.        | 83.8                        | 3.84              | 2.73       | 16.4                            | 18.4           | 12.9 | 134                              |
| 6       | Feramate | "             | 8 min.        | 82.2                        | 4.01              | 2.65       | 17.0                            | 18.7           | 12.7 | 134                              |
| 7       | Maneb    | "             | 8 min.        | 86.4                        | 2.91              | 2.61       | 17.6                            | 18.9           | 12.3 | 134                              |
| 8       | Dichlone | "             | 8 min.        | 85.4                        | 3.39              | 3.48       | 17.3                            | 18.1           | 11.9 | 132                              |

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TABLE V

FORCE AGING OF TOBACCO TREATED WITH CHEMICALS  
FOR WEATHER FLECK CONTROL - 1961 CROP

| Treatment                         | Temperature (°F.) / Date |    |    |    |    |    |    |     |     |     |     |     |     |     |          |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----------------------------------|--------------------------|----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|                                   | January                  |    |    |    |    |    |    |     |     |     |     |     |     |     | February |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|                                   | 8                        | 9  | 10 | 11 | 12 | 15 | 16 | 17  | 18  | 19  | 22  | 23  | 24  | 25  | 26       | 29  | 30  | 31  | 1   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Formate Treated<br>leaf-tips      | 44                       | 53 | 61 | 72 | 76 | 85 | 93 | 98  | 98  | 98  | 103 | 104 | 103 | 107 | 107      | 107 | 108 | 108 | 108 | 108 | 108 | 108 | 108 | 108 | 108 | 108 | 108 | 108 | 108 | 108 | 108 | 108 | 108 |     |
| Formate Treated<br>sands-cutters  | 45                       | 55 | 63 | 72 | 76 | 89 | 94 | 98  | 98  | 98  | 102 | 103 | 104 | 107 | 107      | 108 | 108 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 |     |
| Nichlone Treated<br>leaf-tips     | 46                       | 56 | 64 | 74 | 78 | 90 | 95 | 99  | 98  | 98  | 102 | 103 | 104 | 107 | 107      | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 |     |
| Dichlone Treated<br>sands-cutters | 50                       | 62 | 69 | 78 | 81 | 94 | 98 | 102 | 102 | 102 | 105 | 104 | 106 | 107 | 109      | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 |     |
| Maneb Treated<br>leaf-tips        | 45                       | 57 | 64 | 73 | 77 | 91 | 97 | 99  | 101 | 101 | 105 | 104 | 105 | 107 | 109      | 109 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 |     |
| Maneb Treated<br>sands-cutters    | 47                       | 57 | 64 | 75 | 79 | 91 | 96 | 99  | 99  | 99  | 104 | 104 | 104 | 107 | 108      | 108 | 108 | 108 | 108 | 108 | 108 | 108 | 108 | 108 | 108 | 108 | 108 | 108 | 108 | 108 | 108 | 108 | 108 | 108 |
| Control<br>leaf-tips              | 44                       | 56 | 62 | 72 | 76 | 90 | 93 | 99  | 99  | 99  | 104 | 104 | 105 | 107 | 109      | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 |     |
| Control<br>sands-cutters          | 47                       | 56 | 64 | 74 | 78 | 90 | 95 | 98  | 99  | 99  | 102 | 104 | 104 | 107 | 107      | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 |

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TABLE VI

RESULTS OF TESTS DURING PROCESSING AT MONTREAL PLANT

Moisture (Ave. of 5 tests)

| <u>Treatment</u> | <u>Cutter</u> | <u>Cooler</u> | <u>Location</u>            |                    |
|------------------|---------------|---------------|----------------------------|--------------------|
|                  |               |               | <u>Making Machine</u>      | <u>Q.C. Shaker</u> |
|                  |               |               | <u>(Garniture Tobacco)</u> |                    |
|                  |               |               | <u>Hopper</u>              |                    |
| Fermate          | 18.7          | 15.1          | 14.5                       | 14.0               |
| Dichlone         | 18.1          | 14.8          | 14.0                       | 14.3               |
| Maneb            | 20.0          | 14.9          | 14.4                       | 14.3               |
| Control          | 18.7          | 15.0          | 14.8                       | 14.6               |

Screening (Ave. of 5 x 100 oz. samples)

| <u>Treatment</u> | <u>Location</u> | <u>% Over</u><br><u>1" mesh</u> | <u>% Over</u><br><u>½" mesh</u> | <u>% Over</u><br><u>8 mesh</u> | <u>% Over</u><br><u>20 mesh</u> | <u>% Thru</u><br><u>20 mesh</u> |
|------------------|-----------------|---------------------------------|---------------------------------|--------------------------------|---------------------------------|---------------------------------|
| Fermate          | Cooler          | 14.60                           | 21.15                           | 28.80                          | 29.15                           | 6.30                            |
| Dichlone         |                 | 16.75                           | 13.95                           | 29.45                          | 32.25                           | 7.60                            |
| Maneb            |                 | 18.55                           | 18.25                           | 29.15                          | 28.50                           | 5.55                            |
| Control          |                 | 11.70                           | 22.65                           | 29.40                          | 29.95                           | 6.30                            |
| Fermate          | Garniture       |                                 | 10.75                           | 33.05                          | 44.25                           | 11.95                           |
| Dichlone         |                 |                                 | 8.80                            | 33.60                          | 45.55                           | 12.05                           |
| Maneb            |                 |                                 | 10.45                           | 34.10                          | 43.70                           | 11.75                           |
| Control          |                 |                                 | 11.25                           | 32.30                          | 44.35                           | 12.10                           |

Cigarette Inspection

| <u>Treatment</u> | <u>Sample Size</u> | <u>% Defective Ends</u> |
|------------------|--------------------|-------------------------|
| Fermate          | 3000               | 0.00                    |
| Dichlone         | 3000               | 0.00                    |
| Maneb            | 3000               | 0.00                    |
| Control          | 3000               | 0.00                    |

Cigarette Stability

| <u>Treatment</u> | <u>Mg. smalls/sq. mm. x 10<sup>3</sup></u> |               |
|------------------|--|---------------|
| Fermate          | 109.76, 107.49                             | Ave. - 108.63 |
| Dichlone         | 128.26, 146.41                             | Ave. - 137.34 |
| Maneb            | 133.32, 143.44                             | Ave. - 138.38 |
| Control          | 115.87, 113.43                             | Ave. - 114.65 |

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TABLE VII

PHYSICAL PROPERTIES OF TOBACCO TREATED WITH CHEMICALS FOR  
THE CONTROL OF WEATHER FLECK - GROWN ON I.T. CO. FARM, 1961

Filling Capacity (of cut tobacco) and Compression (of cigarettes)

| <u>Treatment</u>       | <u>Filling Capacity<br/>c.c./2 gm.</u> | <u>Equilibrium Moisture<br/>at 75°F &amp; 60% R.H.</u> | <u>Compression<br/>0.01 mm.</u> |
|------------------------|--|--|---------------------------------|
| Control - no treatment | 4.86                                   | 13.2   | 120                             |
| Fermate                | 4.80                                   | 13.4   | 123                             |
| Dichlone               | 5.11                                   | 12.8   | 119                             |
| Maneb                  | 4.88                                   | 13.3   | 121                             |

L.S.D. for treatment means (Filling Capacity) at the 95%  
level of significance = .060 c.c./2 g.

Shatterability (Ave. of 10 tests)

| <u>Treatment</u>       | <u>Shatter Index<br/>(i.e. % Fines through<br/>60 mesh screen)</u> | <u>Equilibrium Moisture<br/>at 75°F &amp; 60% R.H.</u> |
|------------------------|--|--|
| Control - no treatment | 9.76   | 13.3   |
| Fermate                | 8.74   | 13.6   |
| Dichlone               | 9.20   | 13.1   |
| Maneb                  | 8.64   | 13.4   |

Colour (Ave. of 5 tests on ground tobacco)

| <u>Treatment</u>       | <u>"L"</u> | <u>"a"</u> | <u>"b"</u> | <u>Δ E</u> |
|------------------------|------------|------------|------------|------------|
| Control - no treatment | 39.6       | 5.1        | 16.9       |            |
| Fermate                | 39.4       | 4.9        | 16.7       | 0.30       |
| Dichlone               | 40.0       | 4.8        | 17.1       | 0.54       |
| Maneb                  | 39.2       | 5.1        | 16.6       | 0.50       |

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Cigarette Rate of Burn (Ave. of 40 cigarettes)

| <u>Treatment</u>       | <u>Time of Burn (min./40 mm.)</u> |                |
|------------------------|-----------------------------------|----------------|
|                        | <u>Average</u>                    | <u>Range</u>   |
| Control - no treatment | 10.4                              | 9 1/2 - 11 1/2 |
| Fermate                | 9.7                               | 9 - 10 3/4     |
| Dichlone               | 10.1                              | 9 1/4 - 11     |
| Maneb                  | 10.2                              | 9 1/2 - 11 1/4 |

Cigarette Smoking Test (Difference)

| <u>Comparison</u>   | <u>No. of Smokers<br/>Right</u> | <u>No. of Smokers<br/>Wrong</u> | <u>Conclusion</u>         |
|---------------------|---------------------------------|---------------------------------|---------------------------|
| Fermate vs Control  | 19                              | 19                              | No significant difference |
| Dichlone vs Control | 24                              | 15                              | No significant difference |
| Maneb vs Control    | 19                              | 16                              | No significant difference |

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TABLE VIII

RESULTS OF CHEMICAL ANALYSES ON TOBACCO TREATED  
WITH CHEMICALS FOR WEATHER FLECK CONTROL

| Constituent  | Treatment |                                 |          |                                 |       |                                 | Control |
|--|-----------|---------------------------------|----------|---------------------------------|-------|---------------------------------|---------|
|  | Fermate   |                                 | Dichlone |                                 | Maneb |                                 |         |
|  | %         | % Difference from Control Value | %        | % Difference from Control Value | %     | % Difference From Control Value |         |
| Ash  | 13.6      | -4.9                            | 14.6     | +2.1                            | 13.9  | -2.8                            | 14.3    |
| Sand & Silica  | 0.69      | -6.8                            | 0.56     | -24                             | 0.73  | -1.4                            | 0.74    |
| Calcium (CaO)  | 4.01      | +0.8                            | 4.25     | +6.8                            | 4.21  | +5.8                            | 3.98    |
| Magnesium (MgO)                                      | 0.86      | -11                             | 0.82     | -15                             | 0.85  | -12                             | 0.97    |
| Potassium (K <sub>2</sub> O)                         | 3.87      | -6.5                            | 4.33     | +4.6                            | 4.07  | -1.7                            | 4.14    |
| K <sub>2</sub> O : CaO Ratio                         | 0.96      | -7.7                            | 1.02     | -1.9                            | 0.97  | -6.7                            | 1.04    |
| Phosphorus (P <sub>2</sub> O <sub>5</sub> )          | 0.70      | +9.4                            | 0.86     | +34                             | 0.74  | +16                             | 0.64    |
| Chloride   | 0.68      | +13                             | 0.70     | +17                             | 0.68  | +13                             | 0.60    |
| Protein Nitrogen                                     | 0.86      | -3.3                            | 0.87     | -2.2                            | 0.89  | 0                               | 0.89    |
| Total Nitrogen                                       | 2.26      | +2.7                            | 2.34     | +6.4                            | 2.24  | +1.8                            | 2.20    |
| Nicotine   | 2.22      | +10                             | 2.35     | +17                             | 2.06  | +2.5                            | 2.01    |
| Total Alkaloids                                      | 2.30      | +7.5                            | 2.47     | +15                             | 2.18  | +1.9                            | 2.14    |
| Total Volatile Bases                                 | 0.417     | +5.6                            | 0.462    | +17                             | 0.389 | -1.5                            | 0.395   |
| Reducing Sugars                                      | 18.1      | +1.1                            | 14.4     | -20                             | 17.1  | -4.5                            | 17.9    |
| Sucrose  | 1.3       | +30                             | 0.9      | -10                             | 0.8   | -20                             | 1.0     |
| Total Sugars   | 19.4      | +2.6                            | 15.3     | -19                             | 17.9  | -5.3                            | 18.9    |
| <u>Total Sugars:</u> Ratio<br><u>Total Alkaloids</u> | 8.4       | -4.5                            | 6.2      | -30                             | 8.2   | -6.8                            | 8.8     |
| Petroleum Ether Extract                              | 3.29      | +4.8                            | 3.87     | +23                             | 3.16  | +0.6                            | 3.14    |

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TABLE IX

SMOKE ANALYSIS DATA - TOBACCO TREATED WITH CHEMICALS FOR THE CONTROL OF WEATHER FLECK, GROWN ON THE I. T. CO. FARM - 1961 CROP

| Treatment              | Wt. Range for Cigt. Selection in mg. | Average Pressure Drop (in. of water) | Whole Tar  |           | Nicotine   |           | % Transferred to Smoke |      |      |
|------------------------|--------------------------------------|--------------------------------------|--|-----------|--|-----------|------------------------|------|------|
|                        |                                      |                                      | Wt. of Tobacco smoked/cigt. (mg) (moisture free) | Mg./cigt. | Wt. of Tobacco smoked/cigt. (mg) (moisture free) | Mg./cigt. |                        |      |      |
| Control (no treatment) | 1125 ± 15                            | 3.9                                  | 660.8  | 27.1      | 4.10   | 658.5     | 2.63                   | .399 | 19.8 |
| Fermate                | 1125 ± 15                            | 3.6                                  | 647.4  | 27.9      | 4.30   | 648.3     | 2.66                   | .410 | 18.5 |
| Dichlone               | 1125 ± 15                            | 3.6                                  | 656.0  | 30.0      | 4.57   | 656.4     | 3.14                   | .478 | 20.4 |
| Maneb                  | 1125 ± 15                            | 3.4                                  | 652.9  | 28.0      | 4.28   | 655.6     | 2.74                   | .418 | 20.4 |

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RES-H009-63 c.16  
 \_\_\_\_\_ & Stirling  
 Evaluation Of The Physical, Chemical  
 & Smoking Properties Of Tobacco  
 Grown On The Imp.Tob. Co. Farm  
 1961 Crop

| DATE               | ISSUED TO             |
|--------------------|-----------------------|
| <del>7-20-70</del> | S. Morken             |
| <del>9/27/71</del> | <del>AK 9/24/71</del> |
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| OCT 25 72          | Loren Dyer 72         |
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