Plastic Film As A Soil Surface Cover In Tobacco Plantbeds

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Extensive studies on the comparison of plastic and cheesecloth as covers on tobacco plantbeds have been made by investigators (2, 3, 4) in a number of areas in southeastern United States. These studies revealed a more rapid plant emergence, increased plant populations of more uniform size and a substantial shortening and better control of the amount of time required to produce transplants in plant beds with plastic covers as compared to the normal cheesecloth cover.

The seeding of tobacco plantbeds in Wisconsin begins about April 20 with plants being available for transplanting during the first part of June. The average mean temperature in Madison, Wisconsin for April 20 is 8°C, while the average mean temperature for June 10 is 18°C. With the rapid rise in temperatures and high light intensities during this period, the use of plastic covers for plantbeds has been unsuccessful. The occurrence of high temperatures under the plastic covers results in both rapid soil drying and heat injury to the seedlings. Temperatures as high as 42°C were recorded under a plastic cover on a sunny day when the ambient temperature was 20°C.[2] Air movement through the beds did not reduce the high temperature problem.

Since plastic film as a replacement for the normal cheesecloth plantbed cover is not applicable to Wisconsin conditions, it was thought that a variation in usage of the film might be of value. A tobacco plantbed culture was initiated to determine the effectiveness of plastic film as a ground cover under the normal cheesecloth cover.

Methods and Materials

The tobacco seedbed area was prepared according to standard practices for Wisconsin. This involved fertilization of the soil with 10-10-10 fertilizer at the rate of 435 pounds per acre, cultivation with a rototiller, installation of seedbed frames and fumigation with methyl bromide. Three days after fumigation the beds were seeded with dry tobacco seed, 94 per cent germination, at the rate of 0.1 ounce per 100 square feet. The beds were thoroughly watered after seeding, and an application of tri-basic copper sulfate was made to control damping-off. A sheet of 2-mil clear plastic film was placed on the surface of the soil immediately following the fungicide application and was held in place with U-shaped wire hooks inserted every two feet through the edges of the plastic sheet into the soil. Any water accumulation on the plastic film from rainfall was prevented by a slope to the bed which allowed the water to run off the plastic and prevented physical damage to the plants. Seedbeds without

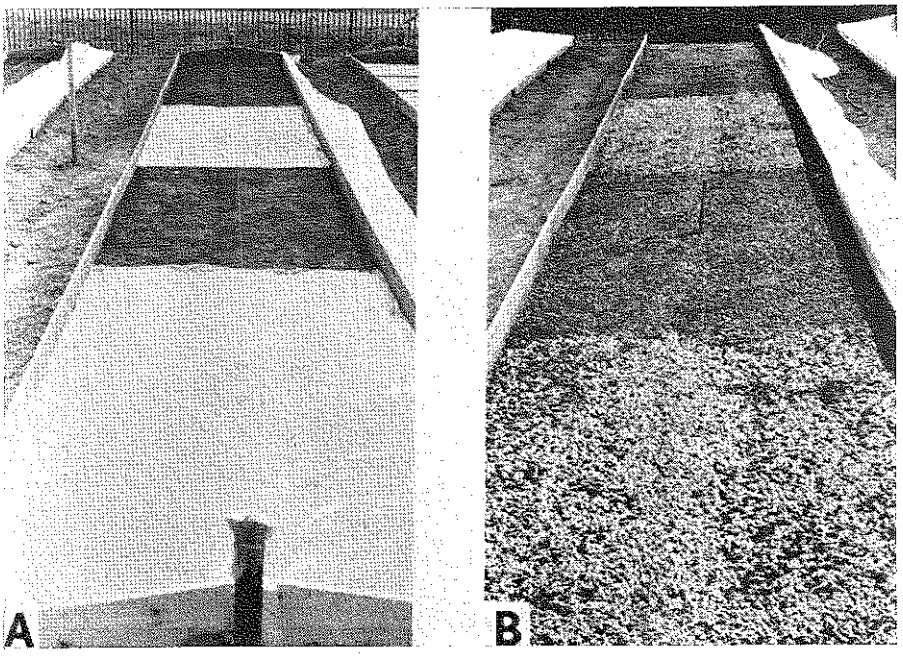

Figure 1. Tobacco plantbeds showing position of plastic at time of seeding (A) and plant development 23 days after seeding (B).

[1]*Contribution from the Horticulture Department, University of Wisconsin, Madison. Published with the approval of the Director, Wisconsin Agricultural Experiment Station.*

[2]*Unpublished data, W. B. Ogden, Research Agronomist, Corps Research Division, A.R.S., U.S.D.A., University of Wisconsin.*

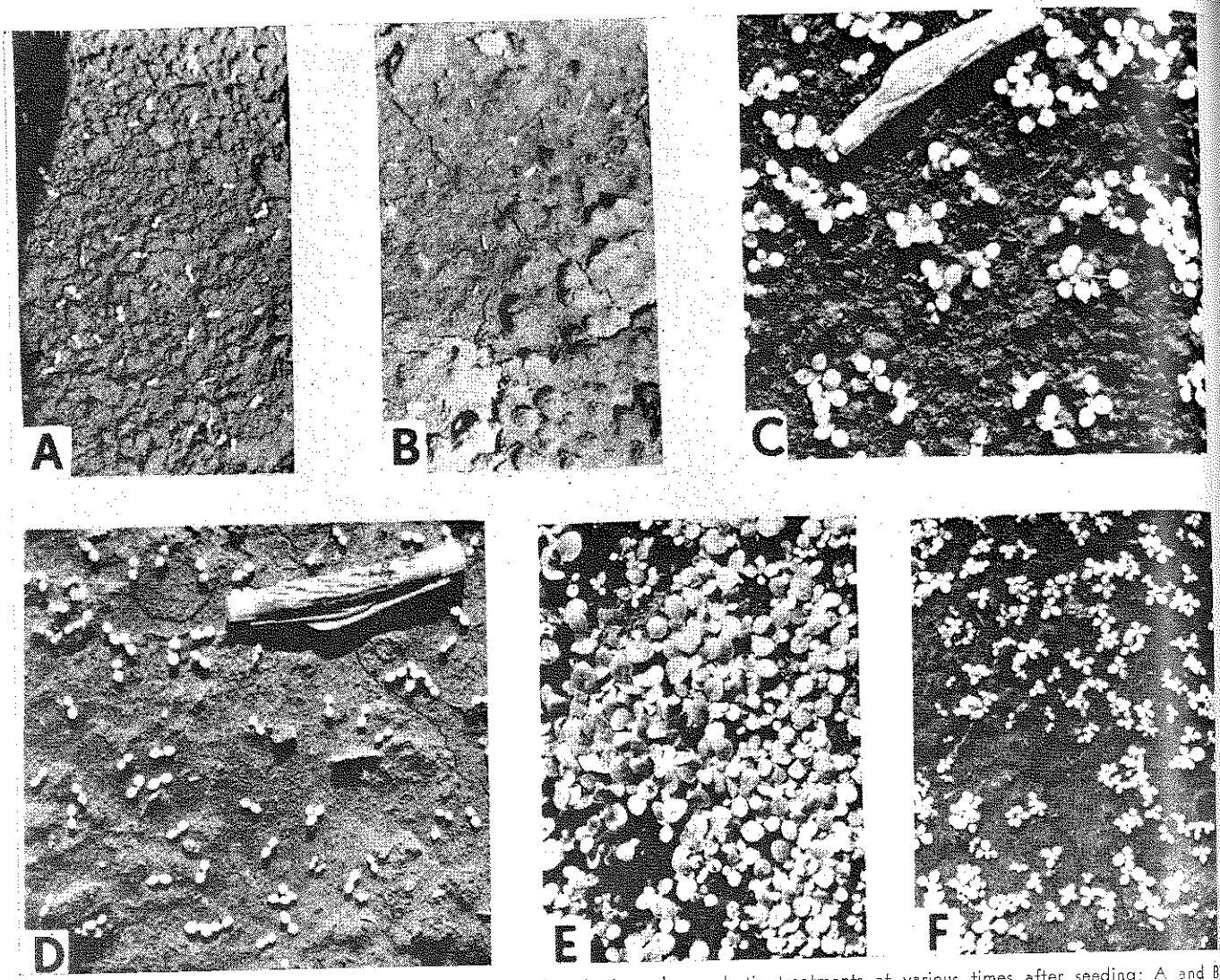

Figure 2. Tobacco seedling development and soil conditions for plastic and non-plastic treatments at various times after seeding; A and B, seven days; C and D, 14 days; E and F, 23 days. A, C and E plastic treatment and B, D and F non-plastic treatment.

plastic, which is the normal practice, were established for comparison. The experimental setup without the cheesecloth cover over the bed is shown in **Figure 1 (A).**

The cheesecloth cover was removed whenever it was necessary to water the non-plastic areas, which was generally a daily occurrence. The non-plastic areas also received a weekly application of fungicide. The plastic sheets were removed only long enough to observe the seedlings and make stand counts. Stand counts were made at various times during the experiment on randomly selected ¼ square foot areas within each treatment.

The plastic sheets were removed 16 days after seeding in one plantbed. A second plantbed was constructed to allow removal of the plastic at three-day intervals starting at 16 days after seeding.

Temperature measurements were recorded at the surface of the soil and at a depth of three inches for the plastic and non-plastic treatments. The surface measurement for the plastic treatment was made just below the plastic sheet. These measurements were taken at seven a.m. and one p.m. (CST) daily for the first 12 days after seeding.

Results and Discussion

The data on emergence of tobacco seedlings with and without a plastic film at the soil surface are presented in Table 1. Seedling development at various times after seeding for the plastic and non-plastic treatments is shown in **Figure 2.** Tobacco seedling cotyledons were first visible under the plastic film five days after seeding (May 2), and eight days (May 5) where no plastic was used. On May 5, 64 seedlings per ¼ square foot were present under the plastic as compared to 11 seedlings for the non-plastic treatment **(Table 1** and **Figures 2(A)** and **2(B). Figures 2(C)** and **2(D)** show the variation in seedling development for the plastic and non-plastic treatments, respectively, on May 13. Plant counts were made on May 20 **(Table 1)** at which time emergence was considered to be complete. One hundred three and 81 plants per ¼ square foot were present in the plastic and non-plastic treatments, respectively. Under the plastic the plant population was considered to be somewhat high for the development of satisfactory transplants. The normal seeding rate for Wisconsin of 0.1 ounce per 100 square feet will need to be reduced to obtain a desired population of about 80 plants per ¼ square foot when plastic film is used.

Under plastic **(Figures 2(A), 2(C)** and **2(E)** the soil remained

TABLE 1. Emergence of tobacco seedlings with and without a plastic film at the soil surface under cheesecloth covers.

Date	Seedlings per 1/4 square foot No plastic*	Plastic*
April 27—seeding date		
May 2	0	7
May 5	11	64
May 20	81	103

*Average for five 1/4 square foot areas.

friable; while for the non-plastic areas (Figures 2B, 2D and 2F) the soil had a definite puddled appearance from daily wetting and drying. Although it seems desirable to maintain a friable soil condition for transplant production, it is not known whether or not this condition had a definite effect on the growth of the tobacco seedlings. However, maintenance of a desirable tilth may be one advantage of using plastic film during the initial stages of transplant production.

Temperatures at the soil surface and three inches below the surface for the plastic and non-plastic treatments, ambient temperatures and sky conditions at seven a.m. and one p.m. for 12 days following seeding are presented in **Figure 3.** At seven a.m. temperatures at the surface and three inches below the surface were about 2.5° and 4°C higher, respectively, for the plastic treatment as compared to the bare soil. At one p.m. the temperatures were about 4°C higher at the surface and 6°C higher at the three-inch depth under plastic as compared to the same points in bare soil. Generally, the temperatures at the surface under the plastic were lower than the ambient temperature at seven a.m. and higher at one p.m. Temperatures at the surface of the bare soil were usually lower than the ambient temperature at both seven a.m. and one p.m. The temperatures below the plastic were obviously beneficial in hastening the emergence of the tobacco seedlings. Army and Hudspeth (1) reported soil temperatures under clear plastic in direct sunlight to range from 49° to 55°C at two p.m. with 27° to 30°C ambient temperatures. Temperature differentials as reported by Army and Hudspeth (1) were not observed in our experiment. Although no light intensity measurements were made, the relationship of the cheesecloth cover to the plastic film would account for possible reduction in intensities such that excessively high soil temperatures under the plastic did not occur.

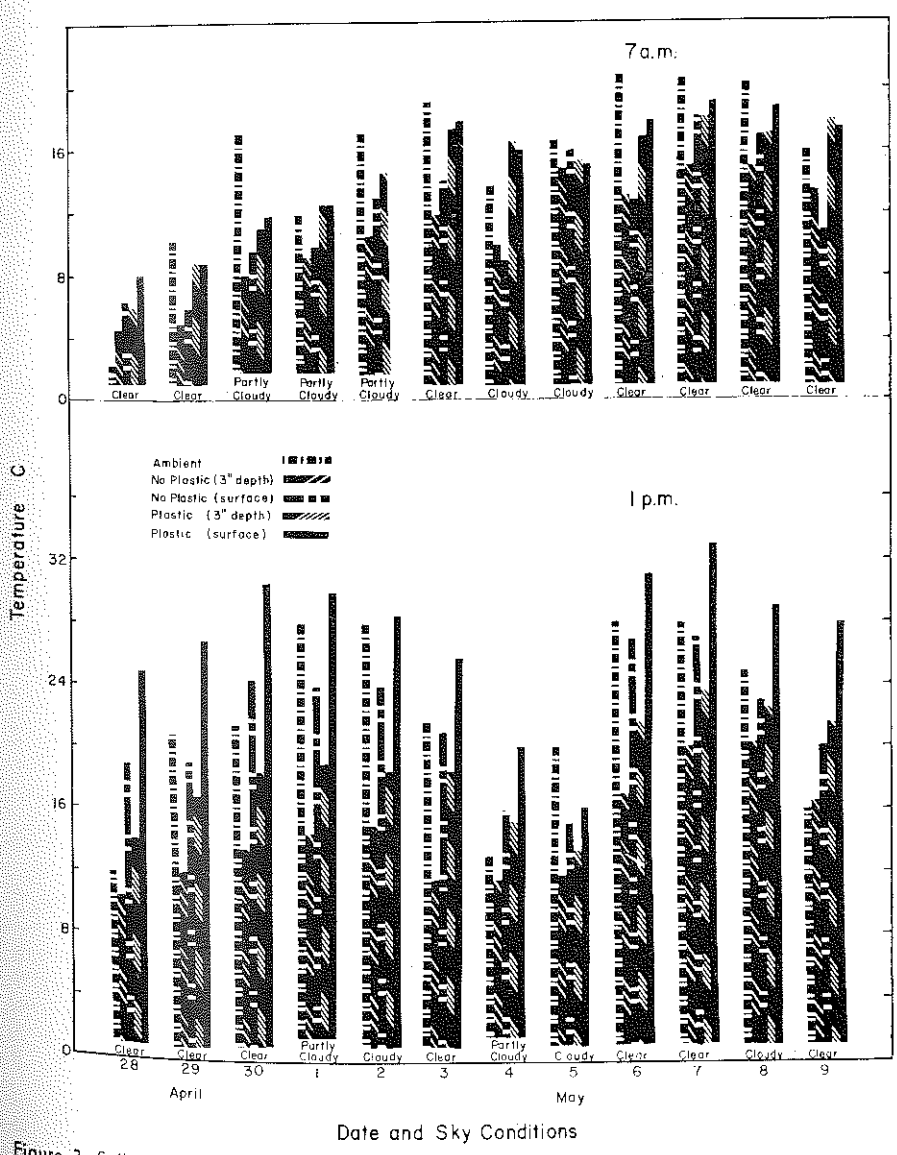

Figure 3. Soil temperatures at the surface and three inches below the surface for plastic and non-plastic treatments, ambient temperatures and sky conditions at seven a.m. and one p.m. daily for a 12-day period.

The elimination of the need for daily watering by the use of plastic film was of prime importance. Starting with soil moisture at field capacity at seeding time, no further watering was required until the plastic film was removed, which was 16 days (May 13) after seeding. The moisture content of soil covered with plastic has been reported by Army and Hudspeth (1) to remain uniform. The tobacco plants were at the five-leaf stage **(Figure 2(C))** under plastic and at the two- to three-leaf stage **(Figure 2(D))** for the non-plastic treatment when the plastic was removed. The differential in plant size, which amounted to about five days growth, was maintained throughout the plant-bed stage. **Figures 1(B), 2(E)** and **2(F)** show the variation in growth 23 days after seeding.

Removal of the plastic film at 16, 19 and 22 days after seeding did not affect the quality of the transplants. However, growth of the plants

seemed to be delayed when the plastic film was left in place for 25 days as compared to plants where the film was removed at the three earlier dates.

Although the plants under plastic were ready for transplanting before those in the non-plastic treatment, a true evaluation of the difference was difficult since the high plant population which resulted under the plastic was undesirable for final development of transplants.

The use of plastic film as a soil surface cover in tobacco plantbeds offers some specific advantages in that it (1) provides more desirable environmental conditions for plant development, e.g., moisture conditions, soil tilth and temperatures; (2) reduces the labor involved in the care of the beds while the plastic is in place; and (3) minimizes traffic in and around the bed area, which may reduce disease problems.

Summary

A tobacco plantbed cnlture study was made to determine the effectiveness of plastic film as a ground cover under the normal cheesecloth bed cover. The two-mil film was placed on the soil surface immediately after seeding and remained in place until the tobacco seedlings were at about the five-leaf stage. The desirable environmental conditions under the film produced more rapid plant emergence of increased plant populations compared to the non-plastic treatment. While the plastic film was in place, no care such as daily watering and weekly fungicide treatments was required.

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