

Soil data: Mean soluble salts levels and nitrate-nitrogen levels during the 1965-66 study were significantly lower in plots mulched with black than with clear film (Table 6). Also, methyl bromide treated plots averaged significantly lower nitrate levels than did the other soil fumigants. A significant interaction between mulch and fumigant indicated that nitrate levels were highest with gray and clear mulch only where the soil treatment was Telone or Telone plus DCPA. With black film, the soil treatments had less effect on the soil nitrate level. It is noteworthy that both soluble salts and soil nitrate levels were low in plots where yields were higher, indicating a utilization of nutrients.

During the 1967-68 study, analysis of soil samples taken every two months indicated that mulch color, soil fumigant, and strawberry clone had not significant effect on soluble salts or nitrogen level. One difference in the two studies was the quantity of fertilizer applied broadcast. In the latter experiment where the treatments had less effect on the measured soil nutrients, 2,000 pounds per acre of 6-8-8 were

broadcast as compared to 1,000 pounds in the earlier experiment. With more adequate fertilizer in the sample area (3), mulch color or soil fumigant had little effect on the remaining soil nutrients.

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RESPONSE OF POTATOES TO MULCHING AT DIFFERENT PLANTING AND HARVESTING DATES

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ABSTRACT

Several surface mulches were tested during the potato growing season. Potato planting and harvesting dates were also varied. Results show that the greatest increase in yield was obtained when black plastic mulch was used at early planting, and the potatoes were harvested early. Yield differences were minimized when the black plastic was applied to late planted potatoes, and they were harvested late in the season. Aluminum foil effects on potato yields were similar to black plastic. Petroleum mulches or wax emul-

sions gave no apparent benefit to production of potatoes.

Differences in soil temperatures between the mulching treatments are discussed.

INTRODUCTION

The yield of potatoes has been increased by utilizing black plastic mulches (4). The effect of mulches and fertilizer rates on the growth of potatoes was further investigated by Hensel (5). Yields have been increased in several crops by use of soil surface mulches (1, 3, 4, 6). The responses have been attributed to earlier germination, more uniform soil moisture, reduced leaching of fertilizer, more optimum weed control, improved crop quality, and in some cases earlier maturity. Soil temperature differences have been attributed to surface mulches, but in

some cases the differences had very little effect on yield (4, 5). The petroleum mulches have shown less consistent increase in growth or yields. Increased in yields have been reported by various workers (2, 6). However, lower potato yields were found when petroleum mulches were applied (5).

For this study, it was proposed that the responses of potatoes to various mulches was dependent upon the date of planting and the length of growing season.

EXPERIMENTAL PROCEDURE

This study was conducted on Rutledge fine sand which had been leveled to a uniform slope. Potatoes had been grown annually for about 60 years. Sebago was the variety of potatoes selected for the test crop.

In 1965, three planting dates and two harvest dates were employed along with five mulching treatments. Planting dates were January 13, January 27, and February 10, and the harvest dates were April 27 and May 20. The mulching treatments were: (1) unmulched, (2) Encap petroleum mulch EAP-2000, supplied by Esso Research and Engineering Company, (3) black polyethylene plastic, 1½ mils, product of Union Carbide Corporation, (4) Sun TerraSeal WL60 clear, and (5) Sun TerraSeal WL60 black. WL60 products were wax emulsions supplied by the Sun Oil Company.

Potatoes were planted using normal management practices of the Hastings area. After planting, the ridged rows were rolled, and the various mulch treatments were applied. Plastic mulch was rolled on top of the rows and anchored on the sides with soil. Liquid petroleum and wax emulsions were applied by adoption of procedures suggested by Scudder and Darby (7).

Soil samples were collected during the growing season and analyzed for available nutrients by methods of the Soil Testing Laboratory at the University of Florida. Specific gravity of tubers was determined by a hydrometer.

In 1966, the experimental variables were altered slightly. Mulching treatments were: (1) unmulched, (2) black plastic, and (3) aluminum foil. Two harvest and two planting dates were also employed.

RESULTS AND DISCUSSION

From the 1965 soil test data, amount of available potassium and magnesium under the

mulches differed significantly. In the black plastic plots, the amounts of potassium and magnesium were 268 and 164 pounds per acre, respectively. The other treatment levels ranged from 142 to 177 for potassium and from 145 to 153 for magnesium. Therefore, the plastic appeared to reduce leaching of both the potassium and magnesium. All other treatments had little or no effect in comparison to the check. The level of available soil calcium and phosphorus did not differ significantly among the mulch treatments.

The effect of mulching and planting dates on yield of potatoes is presented in Table 1. Both a significant linear and quadratic yield effect was associated with planting date. As the date of planting was delayed, an increase in yield was noted. Between the first and second planting dates, the yield differences were small, whereas, between the last two dates they were large. A delay in planting date produced greater yields for all mulching treatments. However, none of the mulching treatments other than black plastic produced larger yields than the check regardless of planting date. On the basis of this test, the petroleum products and wax emulsions would not be recommended for potatoes. One possible reason for the reduction in yield was the high winds which occurred in March 1965. Plants were whipped severely. Petroleum mulch and wax emulsions held the ground firm at the soil line. This caused some physical damage to the plants when they were blown against the mulched soil, whereas, in the plastic and unmulched plots, the soil was pliable and did not produce any physical damage to the plants.

Table 1. Effect of planting dates and mulching treatment on the yield of potatoes - 1965.

Mulch Treatment	Planting dates			Mean
	Jan 13	Jan 27	Feb 10	
	Cwt/A			
Unmulched	151	172	208	177
Encap-2000	131	149	201	160
Black plastic	199	228	246	224
WL-60 clear	142	101	203	149
WL-60 black	135	118	191	148
Mean	152	154	210	

F value:

Planting date** Linear** Quadratic*
 Mulch**
 Planting date x Mulch**

* Significant at 5% level.

** Significant at 1% level.

The black plastic plots produced the largest yields, and when compared to unmulched soil the largest difference in yield was in the plots planted on January 27. Although the effect of harvest date was not significant for the entire experiment, the difference between plastic mulched and unmulched treatments was quite evident. Data for two mulch treatments are presented in Figure 1. The relationship shows that the increase due to plastic was approximately twice as great with the early planting and early harvest combination. Yield increase due to plastic at the April harvest for the first two planting dates was 66 cwt/A, compared to yield difference of only 37 cwt/A at the May

harvest. The figure also shows that length of growing season had very little effect on the yield. The date of planting appears to influence yield more than either the length of growing season or the date of harvest. It also shows that yields of over 200 cwt/A could be produced in 75 days with plastic mulch. When planting was delayed to February 10, yields greatly increased, particularly when harvest was delayed until May.

Specific gravity is sometimes used to indicate quality and chipping yield of potatoes. Potatoes with high specific gravity usually will yield more chips and require less cooking oil during processing. In this experiment, a reduction in speci-

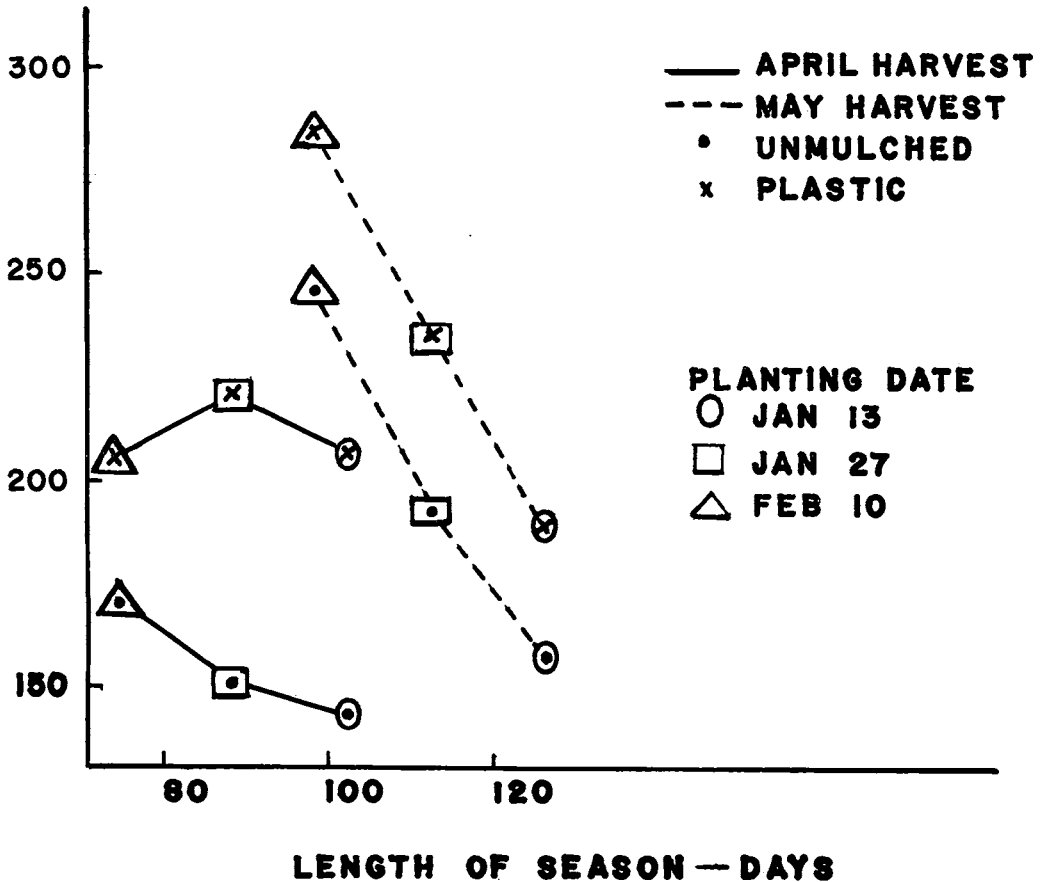


Figure 1. Effect of mulch, planting date, harvest date, and length of growing season on yield of potatoes.

fic gravity was noted when potatoes were mulched with black plastic (Table 2). This would not be as desirable and indicates that tubers under plastic were not as mature as the others. A quadratic relationship existed between the specific gravity values and the planting dates. Possibly the stage of tuber maturation associated with the January 27 planting yielded higher specific gravities than those of other plantings. The other mulching treatments had no significant effect on specific gravity, however, significant interactions were noted between mulch and harvest date and between mulch, harvest date, and planting date. This indicates that the effect of mulch was not the

same at all combinations of planting and harvest dates.

In 1966, only black plastic and aluminum foil were included as mulching variables. Petroleum products and wax emulsions were excluded because of their poor performance in the previous tests. Two planting and two harvest dates were also treatment variables. Dates of planting were January 25 and February 23, and dates of harvest were April 26 and May 17.

Soil temperatures were measured at the 1½" depth with maximum-minimum thermometers. Table 3 shows that the black plastic increased soil temperature, and the aluminum decreased the soil temperature compared to the unmulched

Table 2. Effect of mulching, planting dates, and harvest-
ing dates on specific gravity - 1965.

Mulch	Planting dates			Mean
Treatment	Jan 13	Jan 27	Feb 10	
	April harvest			
Unmulched	1.071	1.074	1.067	1.071
Encap-2000	1.074	1.074	1.071	1.073
Black plastic	1.069	1.072	1.066	1.069
WL-60 clear	1.075	1.076	1.069	1.073
WL-60 black	1.075	1.073	1.071	1.073
Mean	1.073	1.074	1.069	
	May harvest			
Unmulched	1.071	1.075	1.074	1.073
Encap-2000	1.071	1.074	1.069	1.071
Black plastic	1.068	1.070	1.073	1.070
WL-60 clear	1.068	1.074	1.073	1.072
WL-60 black	1.070	1.074	1.072	1.072
Mean	1.070	1.073	1.072	

F value:

Planting date* Quadratic**

Mulch**

Mulch x Harvest date**

Mulch x Harvest x Planting**

* Significant at 5% level.

** Significant at 1% level.

Table 3. Effect of mulches on maximum soil temperature at 1½ inches - 1966.

Mulch Treatment	Time periods		
	3/13-3/18	3/21-3/28	3/29-4/7
	Temperature °F		
Unmulched	76.9	78.1	71.1
Plastic	77.7	81.2	74.5
Aluminum	73.3	75.2	71.1

Table 4. Effect of mulch treatment on emergence of potato plants - 1966.

Mulch Treatment	Observation dates		
	2/21	2/24	2/28
	Percent		
Unmulched	18.8	50.8	76.6
Plastic	38.6	65.5	80.1
Aluminum	42.6	65.8	78.9
Significance	**	**	N.S.

** Significant at 1% level.

N.S. Non-significant.

soil. Both the plastic and aluminum plots had soil temperatures significantly *different from* that of unmulched soil. This was explained since the black plastic absorbed the heat from the sun and the aluminum reflected it. On cloudy days no differences in maximum temperatures were recorded. On a given day, the minimum temperatures for the mulch treatments had a very narrow range and were not significantly different. Associated with the decrease in soil temperature in the aluminum plots, on bright sunny days there was a noticeable increase in air temperature and light intensity above them. When the plants increased in size, the foliage shaded the mulches and reduced their effect on soil temperature.

Effect of the mulching treatments on plant emergence from the soil is shown in Table 4. Both the plastic and aluminum significantly increased the early growth of potatoes. Essentially, a large percentage of the potato plants under the mulch treatments was about one week ahead of unmulched plants. Little or no differences in emergence were noted for the February planting date.

The two mulches did not cause large differences in the available soil nutrients during the 1966 season. The soil test data are presented in Table 5. The pH was consistently lower in the plastic and aluminum mulched plots which was probably a result of reduced leaching of

Table 5. Influence of mulching and planting dates on pH and available nutrients - 1966.

Mulch Treatment	pH		Nutrients (lbs/A)					
	Value		CaO		P ₂ O ₅		K ₂ O	
	Jan	Feb	Jan	Feb	Jan	Feb	Jan	Feb
Unmulched	5.19	5.13	1382	1198	56	41	274	164
Plastic	4.92	5.13	1530	1337	52	45	254	199
Aluminum	4.97	5.11	1382	1093	44	43	256	169
		Mean	1431	1209	51	43	261	177

F value:

P level: Planting date x Mulch**

K level: Planting date**

** Significant at 1% level.

fertilizer salts. No differences due to mulching were found for the calcium, phosphorus, and potassium levels. An interaction in phosphorus levels was found between the planting date and mulching treatments. The differences between potassium level at different planting dates were also significant.

The yield data are presented in Table 6. Both the plastic and aluminum foil increased yields of potatoes planted in January. The yield increase was noted at both harvest dates. However, it was concluded that the mulches produced their effect on the yield prior to the April harvest. Yields for the two mulching treatments were about 80 cwt/A more than the unmulched potatoes at both harvests. Therefore, the growth rates for all treatments were approximately the same during the period of time between the two harvests. For the potatoes planted in February, the differences in yields were not significant.

SUMMARY

Both black plastic and aluminum foil mulches increased the yield of potatoes. The effect of the mulches was greatest when planting was during the latter part of January. Increases in yield resulted from favorable effect during the early part of the growing season while they were not evident during the last month of the season. When planting was delayed until late February, no yield increases resulted from the use of either the black plastic or aluminum.

The use of petroleum mulches and wax emulsions appears to be limited. No economical benefits were associated with either of them.

Table 6. Effect of mulch, planting date, and harvest date on yield of potatoes - 1966.

Treatment	Unmulched	Plastic	Aluminum
	Cwt/A		
January planting			
April harvest	103	191	178
May harvest	178	255	258
February planting			
April harvest	8	3	14
May harvest	280	270	277

F value:

Mulch**, Planting date**, Harvest date**

Mulch x Planting date**

Planting date x Harvest date**

Mulch x Planting date x Harvest date**

** Significant at 1% level.

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