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Studies on the Influence of the time of Planting and Mulching on the Yield of Potato

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Introduction: There are three well-defined seasons for the potato crop on the Nilgiris, of which the main and the second crops occupy nearly 18,500 acres out of the average of 20,000 acres of the total area. The main crop, which is extensively cultivated, is planted in March-April and harvested in August-September. The second crop is raised between August and December. Both these crops are purely rain-fed and cover about 11,500 and 7,000 acres respectively.

The average annual rainfall is about 55 inches, half of which is received during the South-west monsoon rains, which is the period for the growth and maturity of the main crop. The remaining rainfall is received as equal halves, in the North-east monsoon when the second crop is on the field, and as summer rains which are usually accompanied by hail. Both the high winds and the hail-storms are harmful to the two crops, as they damage the haulms of the potato with consequent reduction of yields. Thus, the correct time of planting both the crops assumes great significance, if optimum yields are to be secured against the above adverse factors of seasons and rainfall. In addition, the second crop has to contend against the heavy ground-frost which usually sets in during the middle of December and continues up to the end of February. It is not uncommon if frost appears early in November and continues, in some years, till the end of March or even into April. In such extreme cases, the succulent potato haulms are cut down with heavy loss of yiels.

Trials were undertaken at the Agricultural Research Station, Nanjanad, during the three years 1949. 1950 and 1951, to fix the best time of planting the main and the second crops to secure optimum yields, and the results obained are presented in Section I of this paper. The crop is mainly grown over steep slopes. Hence during particularly heavy downpours, much of the valuable top-soil, with a good quantity of the fertilisers applied, is washed down. It is because of this that the ryots are forced to liberally manure the crop every year, the expenses on this account alone amounting to over Rs. 300/- per acre. The beating effects of the rains do not end with the losses of soil and fertility, but the developing top-tubers are also liable to be exposed to attacks by the tuber moth. Under such conditions, the

damage to the exposed tubers by pests like rabbits, rats, porcupines and wild bears may also prove severe. Due to such exposure the tubers tend to get hard and green before full maturity, resulting in a fall of their market value.

As a consequence of the rich manures applied, the common weeds in the region like spurry, oxalis, and polygonum also grow rank and use up the bulk of the plant food given for the crop. Labour is generally scare and the incessant rains militate against timely weeding of the land. Therefore, any step that would prevent the soil wash and, at the same time, keep the weeds in check, would prove a valuable aid to the farmer in considerably reducing his costs of cultivation and possibly increase his yields. To meet this object, trials were started att he Agricultural Research Station, Nanjanad, to study the effects of mulching the potato crop with dried vegetable refuse like the straw of *Samai (Panicum miliare)*, the cereal which is usually grown in rotation with potato. The results of such a mulching practice, which proved distinctly benefical, are recorded in Section II of this paper.

I. TIME OF PLANTING

Innes and Mac Dermott (1), investigating the loss due to late planting with the variety, *Majestic*, confirmed that delayed planting seriously reduced yields. Harvey (2) indicated that varietal characters had an important bearing on the time of planting, though the variety, *Arran Banner*, did not suffer the loss to the same extent as the variety, *Majestic*. Thomas and Eyre (3) recorded that the condition of the land and locality influenced the time of planting of early potatoes.

The popular early variety of potato, *Great Scot*, was used for the above trials. Four instalments of planting, spaced at fortnightly intervals, were adopted for the two crops af follows:

Treatment	*Main crop*	*Second crop*
A (Standard)	Planted on 15th of March	Planted on 1st of March
B ,,	,, 31st ,,	,, 15th ,,
C ,,	,, 15th of April	,, 1st of Sept.
D ,,	,, 30th ,,	,, 15th ,,

Each treatment was replicated six times. The cultivation and manuring followed were in conformity with the routine practices adopted at the Station. The earliest planted treatment (A) was taken as the standard for assay of yield data.

The summary of results of the trials, seperately for the main and the second crops, is presented in tables I and II.

TABLE I. Summary of results — (Main crop)

	Treatments				General Mean	Standard Error
	A (Std)	B	C	D		
(1949)						
Acre yield in lb.	11528	10904	11540	10652	11156	1136
Percentage on standard	100·0	94·5	100·1	92·3	96·7	4·9
(1950)						
Acre yield in lb.	9880	10120	13160	10480	10910	894
Percentage on standard	100·0	102·4	133·2	106·1	110·4	9·1
(1951)						
Acre yield in lb.	16440	16260	22120	17090	17983	480
Percentage on standard	100·0	99·0	134·5	103·9	109·3	2·9

Conclusions: (1949): No significant differences; (1950): C, D, B, A; (1951): C, D, A, B.

TABLE II. Summary of results — (Second crop)

	Treatments				General Mean	Standard Error
	A (Std)	B	C	D		
(1949)						
Acre yield in lb.	4316	2892	2268	1736	2803	752
Percentage on standard	100·0	67·1	52·5	40·2	64·9	8·7
(1950)						
Acre yield in lb.	4600	3960	2960	3840	3340	346
Percentage on standard	100·0	86·1	64·3	83·5	83·5	7·5
(1951)						
Acre yield in lb.	11840	7280	7520	6240	8220	564
Percentage on standard	100·0	61·5	63·5	52·7	69·4	4·8

Conclusion: (1949): A, B, C, D; (1950: A, B, D, C; (1951): A, C, B, D.

Discussion of Results: The results of all the three years, for both the crops, followed a like pattern. Taking the main crop into consideration, the treatment planted in the middle of April (C) had consistently returned the highest yields for each of the three years of trial. Further, the yield from this treatment was significantly higher than those of the other three for the two years 1950 and 1951. In the case of the second crop, a similar behaviour in favour of highest yields was evident and consistent for the treatment planted at the beginning of August (A), this treatment being significant over the rest in 1951.

II. MULCHING

Information on the subject of mulching the potato crop is limited. It has been recorded by Terman, Libby and Jenkins (6) that a light mulching of the land, after the potatoes are planted, helps to maintain the organic matter added thereby to the soil, making it better. The mulching materials used were partly retted straw, unchopped green grass and clover, and these were applied after the potatoes had been ridged once. Such a practice was observed to increase the yield considerably, while mulching with sawdust tended to lower yield values. Application of an extra dose of nitrogen, at the rate of 60 lb. per acre, further increased the yield of potatoes mulched with grass, but not those mulched with clover. Studying the effect of application of sawdust on the production of fall potatoes for improvement of the texture and water retention of soils, Johnson (4) found that the treatment tended to depress the soil nitrates due to their increased assimilation by bacteria using the sawdust as a source of energy, and concluded that the supply of nitrogen should therefore be increased if sawdust is applied. The use of trash and vegetable debris left on the soil surface, where they can act as a hindrance to evaporation has been mentioned by Keen (5) in the booklet, "Food and the People", published by the Bureau of Current Affairs, London.

The trials under report were conducted over three different crop seasons, viz., the second potato crops of the years 1950 and 1951, and the irrigated crop of 1951. Uniformly graded whole seed tubers of the popular variety, *Great Scot*, were used for the investigations. Cattle threshed dry *Samai* straw and chopped and dried stems of *Juncus glaucus* formed the mulching material. The experimental plots were laid out in randomised blocks, replicated six times. Five treatments were adopted as given below :

A	Control (Unmulched)	
B	Mulched at 1,250 lb.	of vegetable debris per acre.
C	,, 5,000 lb.	,, ,, ,,
D	,, 8,000 lb.	,, ,, ,,
E	,, 10,000 lb.	,, ,, ,,

The mulch material was carefully weighed to conform to the above dosages, and spread out evenly over the related treatments, after planting the potato seed. The yield data for the three seasons, with statistical examination of the results, are summarised in table III.

Section II: MULCHING

TABLE. Summary of Results

Season and Crop	TREATMENTS (A)	(B)	(C)	(D)	(E)	General Mean	Standard Error	Mulch Material	Remarks
Second Crop (1950)									
Acre yield in lb. ..	5,655	4,150	5,100	5,525	5,525	5,245	376	Dry *Samai* straw	Crop cut down by early frost
Percentage on Control (A) ..	100·0	73·7	90·6	103·5	98·2	93·2	3·34	—	—
Second Crop (1951)									
Acre yield in lb. ..	3,400	3,900	5,500	7,850	8,200	5,770	980	Dry stems of *Juncus glaucus*	—
Percentage on Control (A) ..	100·0	100·0	161·7	230 8	241·1	169·6	28·8	—	—
Irrigated Crop (1951)									
Acre yield in lb. ..	4,700	4,900	4,400	6,150	7,200	5,410	82	Dry *Samai* straw	—
Percentage on Control (A) ..	100·0	104·3	93·6	130·8	153·2	116·4	1·7	—	—

Conclusion: Second crop (1950): $\overline{\text{D, A, E, C, B}}$; Second crop (1951): $\overline{\text{E, D,}}$ $\underline{\text{C, B, A}}$; Irrigated crop (1951): E, D, B, A, C.

Discussion of Results: Out of the three crops taken up for the trials, the second crop of 1950 could not grow up to normal maturity, since it was subject to premature damage due to early frost. The other two crops completed their growth and came to lifting under normal seasonal conditions.

As examination of the yield data leads to the conclusion that mulching is conducive to higher potato yields. For instance, in the second crop (1951), the treatments that received mulch at 8,000 and 10,000 lb. per acre, significantly out-yielded the other three treatments including the control while, in the irrigated crop (1951), there were significant yield differences between each and every one of the treatments, the order of superiority being as follows: 10,000 lb., 8,000 lb. and 1,250 lb. of mulch, control and 5,000 lb. of mulch. For the second crop (1950), all the four treatments including the control were significant over the treatment with 1,250 lb. of mulch (B) but, as already stated, the crop was laid low due to severe ground frost before maturity, thus vitiating the yield values. Leaving this crop out of account, the results of the other two have yielded indications in favour of dressing the soil heavily with 8,000 to 10,000 lb. of mulch.

Another point that was evident was that mulching resulted in considerably cutting down the cultivation expenses by saving a course of weeding. Field observations showed that while the weed growth and population were very little or negligible in the mulched treatments, the control plots had to be given a hand-weeding, Normally, a round of weeding takes 50 to 60 women in these parts since, with weeding, the crop has to be carefully, earthed up. Disturbing the soil immediately beneath the plant may, again, tend to injure the stolons that would later develop tubers.

Samai is the main cereal grown in the tract. Since grazing is available in plenty, the cultivators are not very keen on storing the straw for cattle feed, The high cost of transport in the hilly tract is another factor. Hence, the normal practice is to burn the cattle-threshed straw, along with the stubbles left on the field, just before the land is opend for the following potato crop. Thus, this material is available for mulching the potato in abnndance. Even in the absence of this material, any dried vegetable debris may be used.

The benefits of mulching are manifold. The plant residue added to the soils, which are porous and deficient in humus, builds up the organic food reserve of the land thereby enriching it. Its effect on the check of weeds has already been mentioned. Mulching

helps the retention of moisture during the dry whether period (January — April), when the irrigated potatoes are on the field, leading to a reduction in the frequency of watering. During the heavy monsoon periods over which the main and the second potato crops are raised, the mulch protects the top-soil from the beating effects of the downpour, preventing wash-down of the soil and the manure from the land. When showers are so heavy as to lead to sheet or rill erosion, mulching will protect the exposure of the developing tubers nearer the soil surface to the elements and pests. The trials reported are being modified, in view of the results already obtained, to include quantitative studies on the relative moisture-holding capacities of the different treatments, weed population and degrees of severity of incidence of pests like the cut worm and the tuber moth.

Summary and Conclusion: From a review of the yield figures obtained, it is concluded that, to secure optimum yields under Nilgiri conditions, the main and the second crops of potato are best planted respectively by the middle of April and early in August.

Preliminary trials on the results of mulching the land under the potato crop with vegetable debris, at the Agricultural Research Station, Nanjanad, have indicated that such a practice is beneficial for increasing the yield of the crop; besides it acts as an effective check on weed growth and against soil erosion. Further studies on its value in conserving soil moisture and other points are in progress.

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