Detailed information on different aspects of late blight problem in India was secured in the present studies. The results in brief are summarised below.

1. Observations on occurrence, distribution and intensity of late blight showed that in the northern hill ranges the disease appeared annually in a moderate to severe form. At most places in the northern plains blight was observed to appear occasionally in light to severe intensity. The distribution of blight has been shown in maps of India and different States.

It was observed that the disease appeared from 2nd week of May to 4th week of June in the eastern hills. In the western hills, blight was observed to appear sometime from 1st week of July to 1st week of September (table 3). In the southern hills blight appeared in the Nilgiris during 1961 after a lapse of more than 80 years. Since then the disease has been observed to appear there in the 1st week of June in summer crop and by mid-October in the autumn crop. In the northern plains blight appeared from the 4th week of December to 3rd week of March (table 5). In Mysore State (southern plains), blight was observed to appear during July and August.

To represent the temperature, humidity and blight
periods, thermohygrograms were prepared for Simla (western hills), Shillong (eastern hills) and Patna (northern plains) representing the three northern potato growing regions. Thermohygrograms were also prepared for Poona (western plains), Ootacamund (Nilgiri hills) and Bangalore (southern plains) to represent the different regions of Peninsular India.

2. Observations on natural infection of late blight were recorded on the weed flora growing in and around potato fields at Simla and Kufri. Late blight lesions were observed on Nicandra physaloides Gaertn. The lesions developed sporulation on incubation in the laboratory.

106 species representing 88 genera belonging to 32 families of wild and cultivated plants were inoculated in the laboratory. Blight infection was secured in eleven of the species. Young leaves of Nicotiana glutinosa Linn. and Nicandra physaloides Gaertn. developed infection on inoculation.

3. Techniques for obtaining blight affected material from different regions, method of inoculation and necessary equipment required for a study of the physiologic races of Phytophthora infestans (Mont.) de Bary were standardised to suit the local conditions. It was found that blight affected leaves wrapped in slightly moist moss and packed in a small box with holes could be obtained in good condition from places that are not
very far. Inoculated tubers wrapped in paper and packed with paper shavings in a box mostly reached in a good condition from all places in the country.

Results of determination of race of *P. infestans* in 1,058 affected samples collected during 1960 to 1963 from different regions and places in India, revealed the presence of only three races - 0, 1 and 4. Race 0 was dominant in northern parts of the country. At Simla and Kufri besides race 0, race 1 was observed on a restricted scale. Isolates from Shillong were identified as race 0 and 4. In the samples from Nilgiri hills only race 1 was determined.

Two races, 4 and 2.4 were developed in the laboratory by serial passage of race 0 through leaves of genotypes $R_4$ and $R_2R_4$ respectively.

4. Results of the disease reaction tests made with 650 leaf samples of cultures and seedlings of 62 of the tuber-bearing species of *Solanum* are presented (table 17). The results showed that 114 of the seedlings derived from 14 different species were field immune to race 0, 1 and 4.

Out of 589 varieties and hybrids tested for their reaction to late blight, 67 were found field immune to race 0, 66 were resistant and 196 were moderately susceptible.

For developing late blight resistant hybrids, tests were made with old hybrids. Out of 18 selected hybrids,
nine were found to be field immune to race 0 and the
other nine possessed a degree of field resistance.
Seven of these hybrids were utilised in hybridisation.
7,000 seedlings thus raised were initially screened
for resistance to blight. On the basis of further
tests, 99 seedlings were selected and tested in detail
for their foliage and tuber reaction to blight (table
19). Four of these seedlings, SLB/A Nos. 39, 42, 59
and 89, were found to be promising in the yield trials
conducted at different centres of the Central Potato
Research Institute. In subsequent years, 1,080 seed-
lings were selected out of 32,261 seedlings derived
from 45 different crosses. These seedlings are under
further tests in the hills at Kufri and in the plains
at Jullundur.

Seedlings evolved in the commercial breeding
programme of the Institute, were tested and seedling
Nos. A.1243 and A.1570 were found to be field immune
to race 0 and 1 and seedling Nos. A.1239 and A.1528
were field resistant to blight. A.1528 was found to
give a better yield and has now been named 'Kufri
Neela' and released for cultivation. Among the economic
hybrids found promising at the northern centres, S.1756
was found to be field immune to race 0 and susceptible
to race 1. Three other seedlings - S.1758, S.1759
and S.1766 - were found to possess field resistance to
blight. S.1758 was found to be the most promising and
5. In the field trials, it was observed that the unsprayed crop was killed within a month of the first appearance of the disease. The progress of blight for each of the years from 1961 to 1963 is represented in fig. 14. Loss in yield caused by blight was assessed to be 41.7 per cent in 1961, 30.0 per cent in 1962 and 52.3 per cent during 1963.

Studies on losses due to blight tuber rot in the Simla hills showed an average loss of about 5 per cent in the fungicide sprayed crop and 11 per cent in the unsprayed crop (table 26). Highest loss was observed to be about 26 per cent in a grower's unsprayed crop.

It was observed that the incidence of tuber infection was affected by a variety of factors and the data for five such factors is presented. Blight tuber rot losses were observed to be high in (i) large-sized tubers - tables 27 and 28, (ii) heavy soil - table 29, (iii) lower plot position - table 30, (iv) crop sprayed with organic fungicides - tables 31 to 34, and (v) in potato variety Up-to-Date - table 35.

An estimation of losses showed that Mahasu district (Himachal Pradesh) alone suffered an annual loss of potatoes worth 7.5 million rupees on account of damage to the crop caused by late blight. The disease was responsible for an average loss of about Rs. 891
per hectare (page 99).

6. In the fungicidal control experiments, a significant increase in yield over control was obtained by the use of most of the fungicides. Bordeaux mixture proved to be the most effective fungicide with Burgundy mixture as the next best. Among the proprietary preparations, Kirti copper (Cuprous oxide) proved superior to any of the nine copper oxychloride preparations. The three bisdithiocarbamates did not afford a satisfactory protection to the crop. However, among them, Dithane M-45 gave better results. A mixture of Fytolom and Dithane Z-78 also did not prove better than any of the other copper compounds.

Bordeaux mixture 2½:2½:50, to which rosin-soda emulsion had been added as a sticker, proved to be the best formulation of the mixture.

Repetition of fungicidal sprayings every seventh day gave the best protection to the crop against late blight. However, the yields with 7-day intervals of spraying were not much higher than those with 10-day intervals. In view of this and difficulty of covering large areas at short intervals in the difficult hilly terrains, the 10-day interval of spraying was considered satisfactory.