SUMMARY

Productivity of potato in southern transitional zone of Karnataka is mere 10 t ha\(^{-1}\), whereas in the other States of India it is more than 20 t ha\(^{-1}\) and some of the progressive farmers in the State are harvesting 25-30 t ha\(^{-1}\). Keeping this in view, in the present study recently developed/released different potato (\textit{Solanum tuberosum} L.) genotypes of early, medium maturing and processing genotypes were evaluated for growth, yield, storage behaviour, pests, diseases and processing characters. In addition, conducted the experimental trials; the Effect of phosphate solubilising bacteria – \textit{Pseudomonas striata} on growth, tuber yield and economics of potato cv. Kufri Jyoti and the Effect of PHYTON – T, a seaweed extract on growth, yield, economics and incidence of late and early blight diseases in potato cv. Kufri Jyoti. The field experiments were carried out at Agricultural Research Station, Madenur, Hassan during the years, 2007 and 2008. The results of the study were summarised in this chapter.

Chapter 1 CORRELATION AND PATH ANALYSIS OF YIELD ATTRIBUTES OF EARLY MATURING, MEDIUM MATURING AND PROCESSING POTATO GENOTYPES/ HYBRIDS

Early maturing genotypes

Selection for higher leaf area index, tuber dry mater, number of shoots and leaves per plant results not only in higher tuber yield but also in better quality marketable tubers per plant. For early maturity group, selection for medium plant height with profuse vegetative growth is desirable.

The marketable tuber yield per plot recorded the highest direct positive effect of total tuber yield per plot followed by total solids, initial weight of haulm, LAI, tuber dry matter (%), days to 1\(^{st}\) flowering and number of stems per plant. Negative direct effect was observed for weight of marketable tuber yield per plant, followed by specific gravity, plant height, dry weight of haulm, number of leaves and number of marketable tubers per plant.

Medium maturing genotypes

Higher tuber yield, has positive association with number of leaves, leaf area index, plant height among vegetative traits and marketable tuber yield per plot, weight of marketable tubers per plant and number of tubers per plant among tuber.
The total tuber yield indicated highly positive direct effect of marketable tuber yield per plot followed by total solids, dry weight of haulm, initial weight of haulm, number of leaves and number of marketable tuber yield per plant and number of days taken to 1st flowering.

**Processing genotypes**

The growth parameters *viz.*, plant height, number of shoots and number of leaves per plant, tuber dry matter(%), yield parameters *viz.*, processing grade tuber yield per plot and plant, number of processing grade tubers per plant were found to be very important. The quality parameters such as total solids and tuber dry mater(%) also recorded positive association which is suggestive of making selection of both for tuber quality and tuber yield simultaneously.

Observed highest direct positive effect of leaf area index (LAI) followed by processing grade tuber yield per plant, phenol, number of processing grade tubers per plant, tuber dry matter percentage, number of shoots, dry weight of haulm per plant, reducing sugars, days to 1st flowering, initial weight of haulm per plant, plant height and total solids on total tuber yield per plant. The number of leaves per plant recorded direct negative effect followed by total sugars, starch and processing grade tubers per plot on total tuber yield per plot.

**Chapter II  EVALUATION OF POTATO GENOTYPES/HYBRIDS FOR THEIR STORAGE BEHAVIOUR OF EARLY, MEDIUM MATURING AND PROCESSING GENOTYPES/ HYBRIDS AND PROCESSING CHARACTERS OF THE PROCESSING HYBRIDS/GENOTYPES**

**Early maturing genotypes:**

The promising genotype, Kufri Surya recorded less than 2 per cent rotting, sprouting of around 30 per cent, tuber moth infestation of 8.0 per cent, PLW of 4.2 per cent, TWL of less than 6 per cent and dormancy of 80 days. This genotype is a heat tolerant and it realised least storage losses, this may be mainly due to its longer dormancy and unique physico-chemical properties

Though the genotype J/97-243 has longer dormancy of 80 days, but within 10 days period, its sprouting intensity has reached to more than 94 per cent. The genotype Kufri Pukhraj has a dormancy period of 66 days, rotting of less than 2 per cent and attained more than 94 per
cent sprouting within 24 days. The genotype J/96-171 was found to have the dormancy period of 60 days, but the rotting, PTM infestation of tubers, physiological loss of weight (PLW) and total weight loss (TWL) loss were higher.

**Medium maturing genotypes:**

Among the genotypes evaluated, the promising genotypes Kufri Pushkar had the dormancy period of 29 days, 0.4 per cent tuber rotting, 59.1 per cent sprouting, PLW of 5.7 and TWL of 6.1 per cent. The genotype Kufri Pukhraj was found to have longer dormancy i.e., more than 8 weeks, and TWL was less than 10 per cent.

**Processing genotypes:**

The promising genotype Kufri Surya has a dormancy period of 74 days, PLW of 2.7 and TWL of 2.7, PTM infestation of 34.1, sprouting of 38 per cent and no tuber rotting. The TWL was less than 3 per cent and no rotting was observed. The promising genotypes Kufri Surya, MP/99-322 and Atlantic have the chip colour index of less than 3 and that is the acceptable standard.

**Chapter –III** EVALUATION OF EARLY MATURING, MEDIUM MATURING AND PROCESSING HYBRIDS /GENOTYPES FOR MAJOR PESTS AND DISEASES

**Early maturing genotypes**

The promising genotypes, J/96-243, J/96-171, Kufri Pukhraj and Kufri Surya are resistant/immune to sucking pests aphids and yellow mites, the shoot borer, defoliators and tuber infestation (in field) due to PTM. Promising early maturing genotypes J/96-171, Kufri Pukhraj and Kufri Surya were found resistant to late blight disease. The genotypes J/96-171 and Kufri Pukhraj found moderately resistant to early blight disease. The genotypes, Kufri Surya and Kufri Pukhraj found moderately resistant to mild mosaic disease. Against the severe mosaic disease, the genotypes Kufri Surya found resistant and J/98-243 found moderately resistant. Genotypes Kufri Surya found resistant and J/96-171 found moderately resistant to PLRV disease.

**Medium maturing genotypes**

In promising medium maturing genotypes, DSP-7, MS/99-1871, MS/0-3740, Kufri Pukhraj and Kufri Pushkar found resistant against to aphids and yellow mites infestation. Tuber
damage in field due to PTM was least in the genotypes Kufri Pukhraj, MS/0-3740 and Kufri Pushkar. The promising genotypes MS/99-1871, DSP-7, MS/0-3740 and Kufri Pukhraj found resistant to late blight and early blight disease. Against mild mosaic disease the genotype, MS/0-3740 found resistant. Genotypes MS/0-3740, DSP-7, Kufri Pukhraj and Kufri Pushkar found moderately resistant against severe mosaic disease. Genotypes, MS/99-1871, MS/0-3808, Kufri Pushkar and Kufri Pukhraj found resistant and DSP-7 found moderately resistant to PLRV.

**Processing genotypes**

Promising processing genotypes, Kufri Surya, Atlantic, MP/99-322 found resistant to aphids and yellow mites, shoot borer(T), *Spodoptera, Helicoverpa* and leaf blotching. Processing genotypes Kufri Surya, MP/98-172 and MP/99-322 are found resistant, against late blight disease. Against the early blight disease the genotype MP/99-322 found resistant, whereas Kufri Surya, MP/98-172 and Atlantic found moderately resistant. The reaction of the genotypes MP/98-322 found resistant, whereas, Kufri Surya, MP/98-172 and Atlantic found moderately resistant to mild mosaic disease. Among the evaluated 14 advanced early maturing genotypes and four released genotypes, two advanced genotypes J/97-243 and J/96-171 and two released genotypes Kufri Surya and Kufri Pukhraj have shown good adaptability and they are suitable as early maturing genotypes to southern transitional zone of Karnataka.

**Chapter – IV** ASSESSMENT OF POTATO GENOTYPES/HYBRIDS FOR THEIR SUITABILITY TO SOUTHERN TRANSITIONAL ZONE OF KARNATAKA

The Kufri Surya genotype has performed better with respect to tuber yield and stands first and shows good adaptability to the southern transition of Karnataka. The released genotype Kufri Pukhraj has more number of total tubers and high tuber weight, more number of leaves per plant. Advanced genotype J/97-243 has produced more marketable tuber yield per hectare, more number of total tubers and high tuber weight per plant. In addition, it has more numbers of stems, leaf area and leaf area index. Similarly the other advanced genotype J/96-171 has performed well with good tubers yield per hectare with more number and weight of tubers per plant.
Among the 14 advanced developed genotypes evaluated only two genotypes J/97-243 and J/96-171 have performed well and they are at par with the other two released genotypes Kufri Surya and Kufri Pukhraj.

**Medium maturing genotypes**

Kufri Pukhraj has performed better as medium maturing genotypes with good growth as indicated by the production of more number of leaves and stems per plant and yield parameters; fresh weight of haulms, number and weight of small, marketable and total tubers per plant. It is also superior with respect to marketable and total tuber yield per hectare.

The growth parameters; number of stems and leaves per plant of Kufri Pushkar were more. Yield parameters like fresh weight of haulm, number and weight of small, marketable and total tuber yield per plant and marketable and total tuber yield per hectare were also higher.

Among the five advanced genotypes evaluated, only three genotypes DSP-7, MS/-3740 and MS/99-1871 have performed significantly better. The advanced genotype DSP-7 expressed higher growth parameters; in terms of plant height, leaf area, leaf area index as well as yield parameters; such as number and weight of small, marketable and total number of tubers per plant. The other advanced genotypes MS/0-3740 and MS/99-1871 also recorded higher marketable and tuber yield but, not higher than Kufri Pukhraj, DSP-7 and Kufri Pushkar.

**Processing genotypes**

Kufri Surya has the characters *viz.*, early planting, early maturity, short duration and good processing genotype. This genotype also can be used for processing and table purpose. The other promising exotic genotype Atlantic has produced more processing grade tuber yield, specific gravity and total solids. Since the genotype has characters *viz.*, early bulking, short duration and very good processing genotypes, the genotype also can be adapted in double cropping system during *kharif* season in Southern transitional zone of Karnataka. Among the seven advanced processing genotypes evaluated, the genotype MP/99-322 has higher processing grade tuber yield production, more specific gravity and total solids of tubers. This can also be adapted as main crop (medium maturing) to southern transitional zone of Karnataka as one of the processing genotype.
ASSESSMENT OF THE EFFECT OF PHOSPHATE SOLUBILISING BACTERIA – *Pseudomonas striata* and PHYTON – T, A SEA WEED EXTRACT FORMULATION ON GROWTH AND YIELD OF VARIETY KUFRI JYOTI

EFFECT OF PHOSPHATE SOLUBILISING BACTERIA ON POTATO

The plant height, length, breadth and area of 4th leaf from the top were higher at 45 days in the plants treated with the PSB along with reduced quantity of phosphatic fertilizer in RD by 25 and 50 per cent with RD of N and K and with the plants treated with RD of N, P and K. The number of shoots and leaves per plant, fresh and dry weight of haulms, total dry weight of tubers per plant and percentage tuber dry mater content were higher in the plants applied with 25 per cent reduced quantity of RD of phosphatic fertilizers with the PSB + RD of N and K and in the plants treated with RD of N, P and K.

The small tubers of size 0-25 g per plant and hectare were found higher in the plants supplied with the lower quantity or without phosphatic fertilizer. The number and weight of small tubers of size 25-50 g were higher in the plants supplemented with the PSB with reduced phosphatic fertilizer by 25 per cent in recommended dosage along with RD of N and K and RD of N, P and K. The number and weight of medium size tubers i.e., 50-75 g, big size tubers i.e., > 75 g, total tubers per plant and per hectare were influenced much with the application 25 per cent reduced quantity of phosphatic fertilizer in recommended dose along with the PSB + RD of N and K and the plants treated with RD of N, P and K.

The percentage increase of tuber yield over control (47.94%) and over PSB check (7.85%) were found higher in the plants treated with reduced quantity of phosphatic fertilizer of recommended by 25 per cent + RD of N and K followed by RD of N, P and K.

The plant uptake of nitrogen and phosphorous were found higher in the plants treated with reduced quantities of phosphatic fertilizer in recommended by 25, 50 and 75 per cent along with the PSB – *Pseudomonas striata* + RD of N and K followed by the plants applied with RD of N, P and K fertilizers. The plant uptake of potash nutrient was higher in the plants applied with reduced quantities of recommended phosphatic fertilizer by 25 and 50 per cent along with the PSB – *Pseudomonas striata* + RD of N and K. The Phosphorous use efficiency was highest
in the treatment RD of N and K + PSB followed by other treatments; in combination with reduced quantities of P inorganic fertilizer in recommended dose by 25, 50 and 75 per cent along with PSB + RD of N and K. Lowest P use efficiency was observed in the plants treated with only inorganic fertilizers (100 % RD of N, P and K).

The gross and net income per hectare, the advantage of net income over absolute check and PSB check were comparatively higher from the treatments PSB (*Pseudomonas striata*) with RD of N and K along with 25 per cent reduced quantity of phosphatic fertilizer in the recommended dose followed by the RD of N, P and K. The benefit cost ratio and incremental benefit cost ratio (1.90 and 20.88, respectively) were higher from the treatment which applied with the PSB- *Pseudomonas striata* + RD of N and K along with 25 percent reduced quantity of phosphatic fertilizer and the treatment applied with RD of N, P and K (1.79 and 19.98, respectively).

With additional investment of Rs. 340/- to impose the treatment in combination of the PSB with 25 per cent reduced quantity of phosphatic fertilizer in the recommended dose along with RD of N and K, that has given an incremental benefit cost ratio higher than the RD of N, P and K applied plants.

**SEAWEED EXTRACT - PHYTON-T ON POTATO**

Significant influence of the spray of different concentrations of seaweed extract PHYTON-T in combination with mancozeb (0.3%) at 25th, 34th and 45th day after planting when recorded at 75 days after planting was found on plant growth parameters *viz.*, number of shoots and leaves per plant and plant height in the plants sprayed with higher concentration of the seaweed extract – PHYTON-T i.e., (0.5%) 5 ml l⁻¹ followed by (0.4%) 4 ml l⁻¹ and (0.3%) 3 ml l⁻¹ in combination with 0.3 per cent mancozeb.

The growth, yield and quality parameters *viz.*, length, breadth and area of 4th leaf from top, dry weight of haulm per plant, tuber dry matter percentage, dry weight of tubers per plant, tuber specific gravity and total solids were found higher when recorded at 75 days after planting in the plants sprayed three times at 25th, 35th and 45th day after planting with seaweed extract – PHYTON-T with the concentrations 0.5 and 0.4 per cent in combination with mancozeb 0.3 per cent.
The number and weight of marketable tubers, total tubers per plant, total tuber yield per hectare and percentage increase in tuber yield over control were higher in the plants sprayed three times at 25, 35 and 45 days after planting with seaweed extract – PHYTON-T in the concentrations 0.5 per cent (3.13 number and 298.26 g plant\(^{-1}\), 3.89 and 309.24 g plant\(^{-1}\), 231.93 q ha\(^{-1}\) and 39.13 %, respectively) and 0.4 per cent (2.94 and 257.90 g plant\(^{-1}\), 3.55 and 271.68 g plant\(^{-1}\) 203.76 q ha\(^{-1}\), 22.27%, respectively) in combination with mancozeb 0.3 per cent.

The biochemical contents viz., reducing, none reducing and total sugars contents were higher in the harvested tubers from the treatments which sprayed three times with the seaweed extract, PHYTON-T in the concentrations of 0.5, 0.4 and 0.3 per cent along with mancozeb 0.3 per cent.

The net income over check was higher in the plants sprayed in combination with seaweed extract – PHYTON-T at 0.5 per cent concentration followed by 0.4 per cent and 0.3 per cent along with mancozeb 0.3 per cent. The benefit cost ratios and incremental benefit cost ratios of the treatments were higher in the plants sprayed three times with seaweed extract – PHYTON-T in the concentration of 0.5 per cent followed by 0.4 per cent and 0.3 per cent along with mancozeb 0.3 per cent.

The late blight disease was not observed at 24\(^{th}\) and 34\(^{th}\) day observations in different treatment during both the years. The disease severity was lower at 44\(^{th}\) day observation in the plants sprayed with 0.5 and 0.4 per cent concentrations of the seaweed extract - PHYTON-T in combination with mancozeb 0.3 per cent. At the 80\(^{th}\) day observation, it was lower in the plants sprayed with higher concentration of seaweed extract PHYTON-T i.e., 0.5 per cent followed by 0.4 per cent in combination with mancozeb 0.3 per cent. The early blight disease also was not observed up to 24\(^{th}\) day, but at 34\(^{th}\) day observation, it was noticed in negligible percentage. At 44\(^{th}\) day and on wards disease was observed in different treatments with varied disease severity. The disease severity was lower at 44\(^{th}\) day observation in the plants treated with seaweed extract PHYTON-T at concentrations 0.5 and 0.4 per cent in combination with mancozeb 0.3 per cent. At 80\(^{th}\) day, it was lower only in the plants treated with seaweed extract PHYTON-T at 0.5 per cent concentration followed by 0.4 per cent in combination with mancozeb 0.3 per cent.