

Efficacy of organics, bio-inoculant and mulching on the performance of strawberry (*Fragaria x ananassa* Duch.) cv. Chandler grown on partially reclaimed alkali soil of central Uttar Pradesh

THESIS

Submitted to the
Babasaheb Bhimrao Ambedkar University, Lucknow
(A Central University)
Lucknow

**BABASAHEB
BHIMRAO
AMBEDKAR
UNIVERSITY**



• LUCKNOW •
प्रज्ञा शील करुणा
ESTABLISHED 1996

For the Degree of

DOCTOR OF PHILOSOPHY

in

HORTICULTURE

Submitted by:

Neeraj Kumar Verma

Enrolment No. 775/06

Co-Supervisor:

Dr. T. Damodaran

Principal Scientist
ICAR- C S S R I,
Regional Research Station,
Lucknow -226002 (UP), India

Supervisor:

Prof. R. B. Ram

Department of Horticulture
School of Agricultural Sciences and Technology
Babasaheb Bhimrao Ambedkar University,
(A Central University)
Vidya Vihar, Rae Bareli Road
Lucknow-226025 (UP), India

2021

SUMMARY of THESIS

The present investigation entitled “Efficacy of organics, bio-inoculant and mulching on the performance of strawberry (*Fragaria x ananassa* Duch.) cv. Chandler grown on partially reclaimed alkali soil of central Uttar Pradesh” was carried out during 2017-18 and 2018-19. The experiment was conducted at the Horticulture Research Farm of the Department of Horticulture, School of Agricultural Sciences and Technology, Babasaheb Bhimrao Ambedkar University, Vidya Vihar, Rae Bareilly Road, Lucknow (UP), India. The experiment was laid out in randomized block design (RBD) with having twelve treatments along with control and replicated thrice.

The results of present investigation concerning to efficacy of organics, bio-inoculant and mulching on the vegetative growth, flowering, fruiting yield and fruit quality parameters of strawberry and soil properties have been summarized in this chapter.

1. The tallest plants were found with 100% NPK + mulch (paddy straw) application followed by 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant whereas, smallest plants were noted in control. It also has been obtained that the individual as well as combined application of an organics, bio-inoculant and mulching was statistically at par.
2. The maximum plant spread was observed with 100% NPK + mulch (paddy straw) application and followed by 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant. Whereas, minimum plant spread were scored in control. Plant spreads under different treatment combinations varied from 12.00 to 17.68 cm over a period of 120 days (E-W) after planting.
3. The maximum leaf length was achieved with 100% NPK + mulch (paddy straw) application followed by 75% NPK + MSWC + mulch (paddy straw) + Bio-inoculant whereas, minimum leaf length was noted in control in two consecutive years.
4. Plants treated with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant resulted in maximum leaf area was found and followed by that in treatment where

100% NPK + mulch (paddy straw) was applied. However, minimum leaf area was noted in control.

5. The highest length of petiole was produced with 100% NPK + mulch (paddy straw) application followed by 50% NPK + MSWC + mulch (paddy straw) whereas, lowest length of petiole was found in control in two consecutive years.
6. The maximum number of leaves was recorded with 100% NPK + mulch (paddy straw) application followed by 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant whereas; minimum number of leaves was scored in control.
7. The minimum days to first flowering was recorded with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant application followed by 50% NPK+ MSWC+ mulch (paddy straw) + bio-inoculant. However, maximum days to first flowering were found in control.
8. A maximum number of flowers were found with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant application followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant. Whereas, minimum number of flowers was found in control.
9. The highest length of pedicel was achieved with 100% NPK + mulch (paddy straw) application followed by 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant. However; lowest length of pedicel was noted in control in two consecutive years.
10. The minimum days to first fruit set was recorded with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant application followed by 50% NPK+ MSWC+ mulch (paddy straw) + bio-inoculant however, maximum days to first fruit set was found in control.

- 11.** Plants treated with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant get maximum number of fruits per plant followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant. Whereas, minimum fruits per plant were found in control.
- 12.** Percentage of fruit setting per plant was maximum produced with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant application followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant. However, minimum was found in control.
- 13.** The highest duration of fruit harvesting was scored with 100% NPK + mulch (paddy straw) application followed by 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant. However, minimum duration of fruit harvesting was found in control in two consecutive years.
- 14.** The maximum numbers of runners/plant was produced with 100% NPK + mulch (paddy straw) application followed by 75% NPK+FYM + mulch (paddy straw) + bio-inoculant. However, minimum numbers of runners/plant was scored in control in two consecutive years.
- 15.** The highest fruit length was obtained with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant application followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant whereas, minimum length of fruit was found in control in two consecutive years.
- 16.** The maximum diameter of fruit was achieved with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant application followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant however; minimum diameter of fruit was noted in control in two consecutive years.

- 17.** Plants treated with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant obtained maximum size of fruit and followed by 100% NPK + mulch (paddy straw) whereas, minimum size of fruit was recorded in control in two consecutive years.
- 18.** The maximum volume of fruit was achieved with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant application followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant whereas, minimum volume of fruit was found in control in two consecutive years.
- 19.** The maximum fresh fruit weight was showed with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant application followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant whereas, minimum fresh fruit weight was found in control in two consecutive years.
- 20.** Plants treated with 75% NPK + FYM + mulch (paddy straw) produced maximum specific gravity with application followed by 50% NPK + MSWC + mulch (paddy straw) + bio-inoculant. Whereas, minimum specific gravity was noted in control.
- 21.** Significantly maximum dry fruit weight was achieved with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant application followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant. Whereas, minimum dry fruit weight was found in control in two consecutive years.
- 22.** The maximum fruit yield/plant was found with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant application followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant. Whereas, minimum fruit yield plant⁻¹ was recorded in control in two consecutive years.
- 23.** The maximum fruit yield/plot was obtained with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant application followed by 75% NPK + FYM + mulch

(paddy straw) + bio-inoculant. Whereas, minimum fruit yield plot⁻¹ was scored in control in two consecutive years.

- 24.** The maximum fruit yield/ha was recorded with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant application followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant. Whereas, minimum fruit yield ha⁻¹ was noted in control in two consecutive years.
- 25.** The maximum pH of fruit juice was showed with 75% NPK + FYM + mulch (paddy straw) + bio-inoculant application followed by 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant. Whereas, minimum pH of fruit juice was scored in control in two consecutive years.
- 26.** Significantly, maximum total soluble solids (⁰brix) of fruit juice were achieved with 75% NPK+ FYM + mulch (paddy straw) + bio-inoculant application followed by 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant. Whereas, minimum total soluble solids (⁰Brix) was found in control in two consecutive years.
- 27.** Titratable acidity of fruit juice was minimum recorded with 75% NPK+ FYM + mulch (paddy straw) + bio-inoculant application followed by 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant. Whereas, maximum titratable acidity was scored in control in two consecutive years.
- 28.** The maximum TSS/Acid ratio of fruit juice was recorded with 75% NPK+ FYM + mulch (paddy straw) + bio-inoculant application followed by 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant. Whereas, minimum TSS/Acid ratio was found in control in two consecutive years.
- 29.** Significantly maximum ascorbic acid content of fruit juice was obtained with Control application followed by 100% NPK + mulch (paddy straw). Whereas, minimum ascorbic acid content was recorded in 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant in two consecutive years.

- 30.** Total sugars content of fruit juice was maximum showed with 75% NPK + FYM + mulch (paddy straw)+ bio-inoculant application followed by 75% NPK + MSWC + mulch (paddy straw)+ bio-inoculant whereas, minimum total sugars content was scored in control in two consecutive years.
- 31.** The maximum reducing sugar content of fruit juice was achieved with 75% NPK + FYM + mulch (paddy straw) + bio-inoculant application followed by 75% NPK + MSWC + mulch (paddy straw). Whereas, minimum reducing sugar content was found in control in two consecutive years.
- 32.** Significantly maximum non-reducing sugar content of fruit juice was found with 75% NPK + FYM + mulch (paddy straw) + bio-inoculant application followed by 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant. Whereas, minimum total non-reducing sugar content was scored in control in two consecutive years.
- 33.** Anthocyanin content of fruit juice maximum was recorded with 75% NPK + MSWC + mulch (paddy straw) application followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant. Whereas, minimum anthocyanin content was found in control in two consecutive years.
- 34.** The maximum soil moisture was recorded under 75% NPK + FYM + mulch (paddy straw) + bio-inoculant at 30 DAP, 75% NPK + mulch (paddy straw) at 45 DAP, 50% NPK + MSWC + mulch (paddy straw) at 60 and 105 DAP, 50% NPK + mulch (Paddy straw), at 75 DAP and 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant at 90 and 120 DAP .respectively followed by 50% NPK + MSWC + mulch (paddy straw) at 30 and 45 DAP, 75% NPK + FYM + mulch (paddy straw) at 60DAP, 50% NPK + FYM + mulch (paddy straw) at 75, 90 and 105 DAP and 75% NPK + FYM + mulch (paddy straw) + bio-inoculant at 120 DAP, respectively. Minimum values were recorded under control at different days after planting in all the respective treatments.

- 35.** Soil temperature was recorded maximum under control at 30, 75, 90,105 and 120 DAP ,respectively, but at 45 and 60 DAP it was found maximum under 50% NPK + MSWC + mulch (paddy straw) and 50% NPK + MSWC + mulch (paddy straw) + bio-inoculant respectively followed by 100% NPK + mulch (paddy straw) at 30 and 120 DAP, at 45 DAP in 75% NPK + MSWC + mulch (paddy straw) and at 60, 90 and 105 DAP in 75% NPK + FYM + mulch (paddy straw) + bio-inoculant and at 60DAP 50% NPK + FYM + mulch (paddy straw), respectively. Minimum value at 30 and 105 DAP in 50% NPK + FYM + mulch (paddy straw), at 45, 75 and 90 DAP in 50% NPK + FYM + mulch (paddy straw) + bio-inoculant, at 60DAP in 100% NPK + mulch (paddy straw) and at 120 DAP under75% NPK + MSWC + mulch (paddy straw) + bio-inoculant.
- 36.** Maximum soil pH was found under control followed by 50% NPK + mulch (paddy straw). Whereas, minimum soil pH was found in 50% NPK + MSWC + mulch (paddy straw) + bio-inoculant in two consecutive years.
- 37.** Maximum electrical conductivity was recorded under control followed by 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant. Whereas, minimum electrical conductivity was found under control in two consecutive years.
- 38.** Maximum organic carbon percent was found under 75% NPK + MSWC + mulch (paddy straw) and 75% NPK + FYM + mulch (paddy straw) + bio-inoculant respectively followed by 75% NPK + FYM + mulch (paddy straw) and 50% NPK + FYM + mulch (paddy straw). Whereas, minimum organic carbon percent was found under control in two consecutive years.
- 39.** Microbial population count was maximum recorded under 50% NPK+ FYM + mulch (paddy straw) + bio-inoculant application followed by 50% NPK + MSWC + mulch (paddy straw) + bio-inoculant whereas, minimum microbial population noted was found in control.

- 40.** Maximum available nitrogen content was found in 50% NPK+ FYM + mulch (paddy straw) + bio-inoculant followed by 50% NPK + MSWC + mulch (paddy straw) + bio-inoculant. Whereas; minimum available nitrogen content was found under control.
- 41.** Maximum available phosphorus content was recorded with 50% NPK + MSWC + mulch (paddy straw) + bio-inoculant followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant. Whereas, minimum available phosphorus content was found under control.
- 42.** Maximum available potash content was recorded with 50% NPK + MSWC + mulch (paddy straw) followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant. Whereas, minimum available phosphorus content was found under control.
- 43.** Maximum benefit: cost ratio was obtained with 75% NPK + MSWC + mulch (paddy straw) application followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant whereas, minimum benefit: cost ratio was found in control in two consecutive years.
- 44.** Maximum net income was also found with 75% NPK + MSWC + mulch (paddy straw) application followed by that obtained with 75% NPK + FYM + mulch (paddy straw) + bio-inoculant. Whereas, minimum net income was found in control in two consecutive years.

CONCLUSION

In the present investigation with different treatments combinations to test the efficacy of organics, bio-inoculant and mulching on vegetative growth, yield, quality and soil parameters in strawberry cv. Chandler, it is an accomplished that application of 100% NPK of RDF significantly increased the plant height, plant spread at 120 DAP, number of leaves, leaf length, leaf width, length of petiole, length of pedicel, duration of harvesting and number of runners plant⁻¹.

The maximum leaf area, days to first flowering, number of flowers, days to fruit set (minimum number of days), number of fruits, percentage of fruit setting, fruit yield plant⁻¹, fruit yield plot⁻¹, fruit yield ha⁻¹. Length of fruit, width of fruit, weight of fruit, volume of fruit, fresh fruit weight, dry fruit weight and quality characters viz., total sugars, reducing sugar, non-reducing sugar and minimum ascorbic acid content were recorded in 75% NPK+MSWC + mulch (paddy straw)+ bio-inoculant. Whereas, specific gravity was maximum with application of 75% NPK + FYM + mulch (paddy straw).

As far as the bio-chemical characters of strawberry fruits are concerned application of 75% NPK + FYM + mulch (paddy straw) + bio-inoculant exhibited highest pH, TSS, TSS/Acid ratio and minimum titratable acidity were recorded whereas, maximum titratable acidity was recorded under control. However, maximum anthocyanin content was obtained under 75% NPK + MSWC + mulch (paddy straw).

Maximum benefit: cost ratio and maximum net income were obtained with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant application followed by 75% NPK + FYM + mulch (paddy straw) + bio-inoculant. Whereas, minimum benefit: cost ratio and maximum net income were also found in control in two consecutive years.

On the basis of above findings, it may be concluded that for getting significantly maximum yield and bio-chemical quality of fruits with more propagating materials of strawberry runners should be fed with 75% NPK + MSWC + mulch (paddy straw) + bio-inoculant and 75% NPK + FYM + mulch (paddy straw) + bio-inoculant in the partially reclaimed alkali soil of central Uttar Pradesh, India.