

# DESIGN, DEVELOPMENT AND EVALUATION OF TRACTOR OPERATED SEEDER FOR MAT TYPE PADDY NURSERY

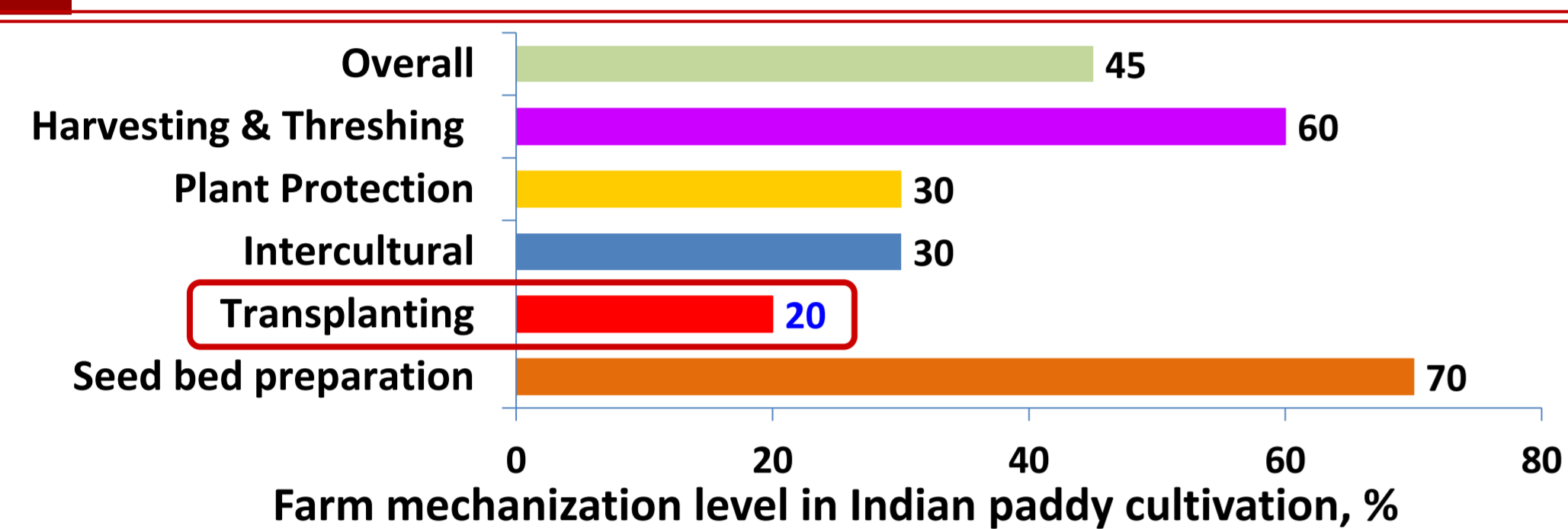
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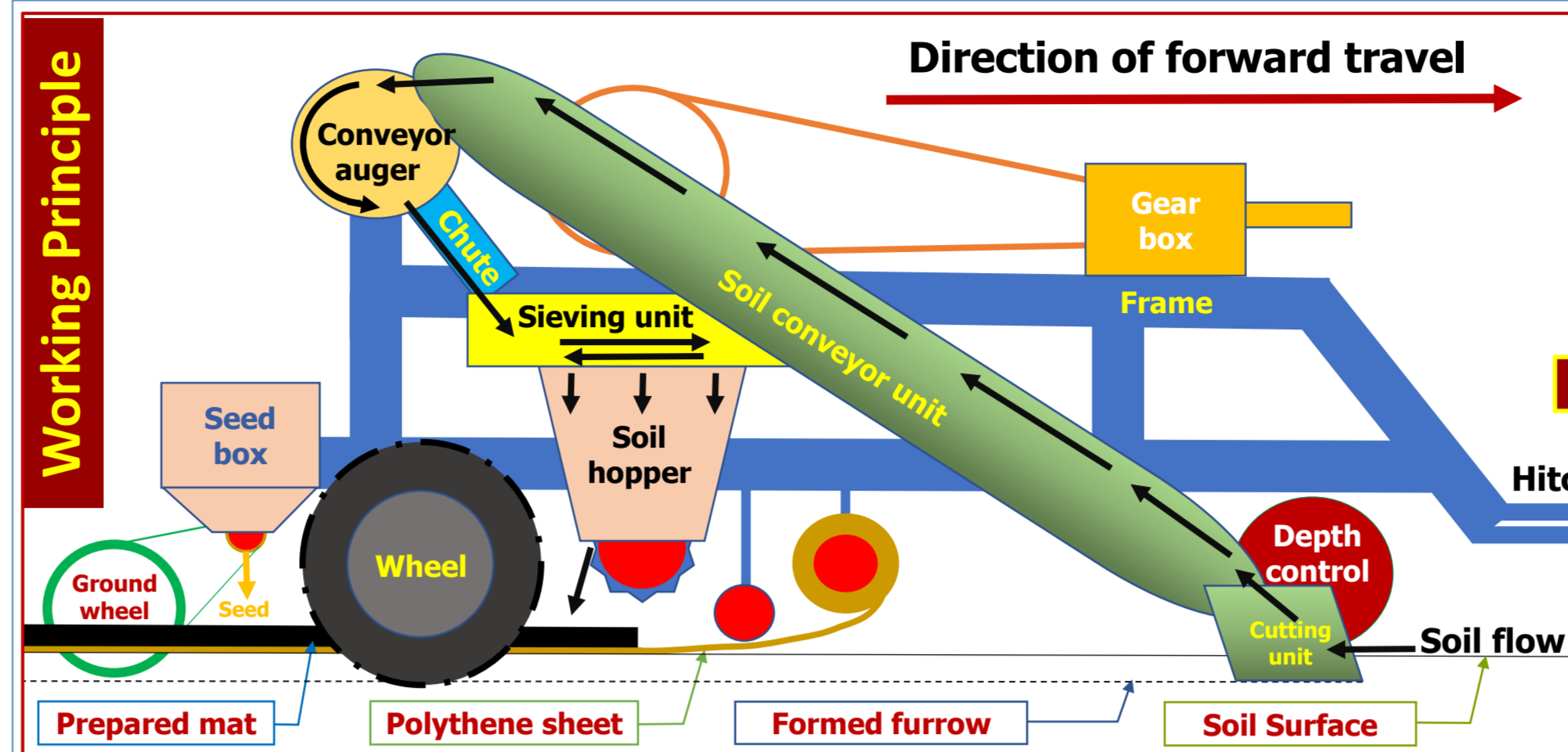
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## 1 Introduction



- Paddy nursery must sown: 20<sup>th</sup> May-5<sup>th</sup> June (16 days)
- Subsequent paddy transplanting: 20<sup>th</sup> June-5<sup>th</sup> July (15 days)
- Window period for transplanting decreased due to water prevention act
- Delayed transplanting of paddy resulted reduction in the yield
- Transplanting operation needs to be mechanized for timely transplanting
- To accomplish all the operations in one go, there was a need to design, develop and evaluate a simple and cost effective tractor operated machine for raising mat type seedlings of paddy.
- Objectives:** (i) To design and develop the tractor operated seeder for mat type paddy nursery (ii) To evaluate the performance of developed tractor operated seeder for mat type paddy nursery in laboratory/ field conditions.

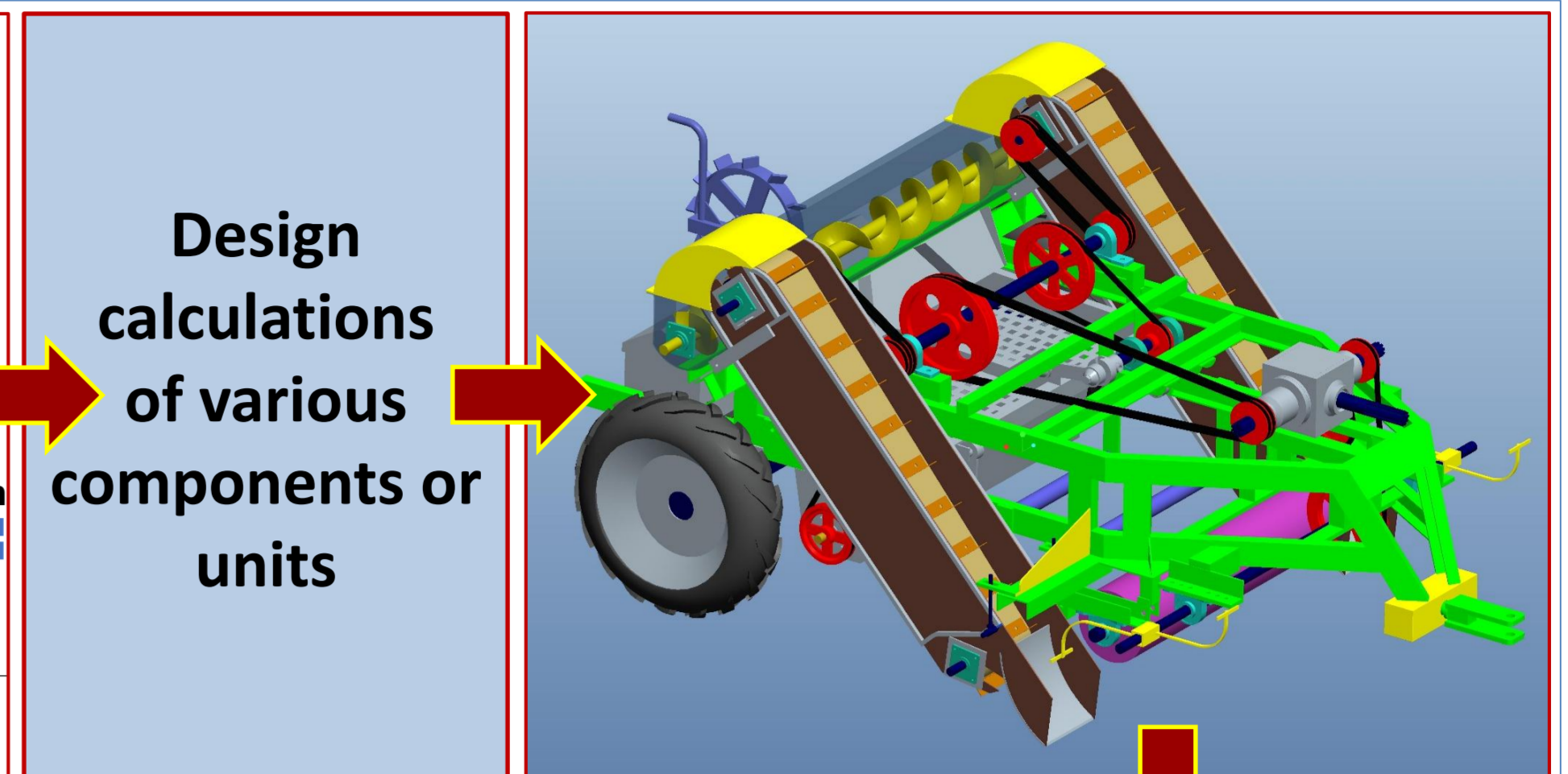
## 2 Materials and Methods



| SN                          | Independent Parameter   | Levels | Details  |
|-----------------------------|---|--------|--|
| Controlled field evaluation |   |        |  |
| 1.                          | Sieve oscillation, O (spm)  | 3      | O1 (238), O2 (318) and O3 (398)                  |
| 2.                          | Sieve size opening, S (mm)  | 2      | S1 (25 × 20) and S2 (50 × 25)                    |
| 3.                          | Depth of soil cut, D (mm)   | 2      | D1 (40) and D2 (80)                              |
| Actual field evaluation     |   |        |  |
| 1.                          | Forward speed, FS (km h <sup>-1</sup> )                                       | 3      | FS1 (1.7), FS2 (2.2) and FS3 (2.7)               |
| 2.                          | Soil type (ST)  | 3      | ST1 (Sandy Loam), ST2 (Loam) and ST3 (Silt loam) |
| 3.                          | Control/ traditional method (Manual raising of mat type nursery using frames) |        |  |

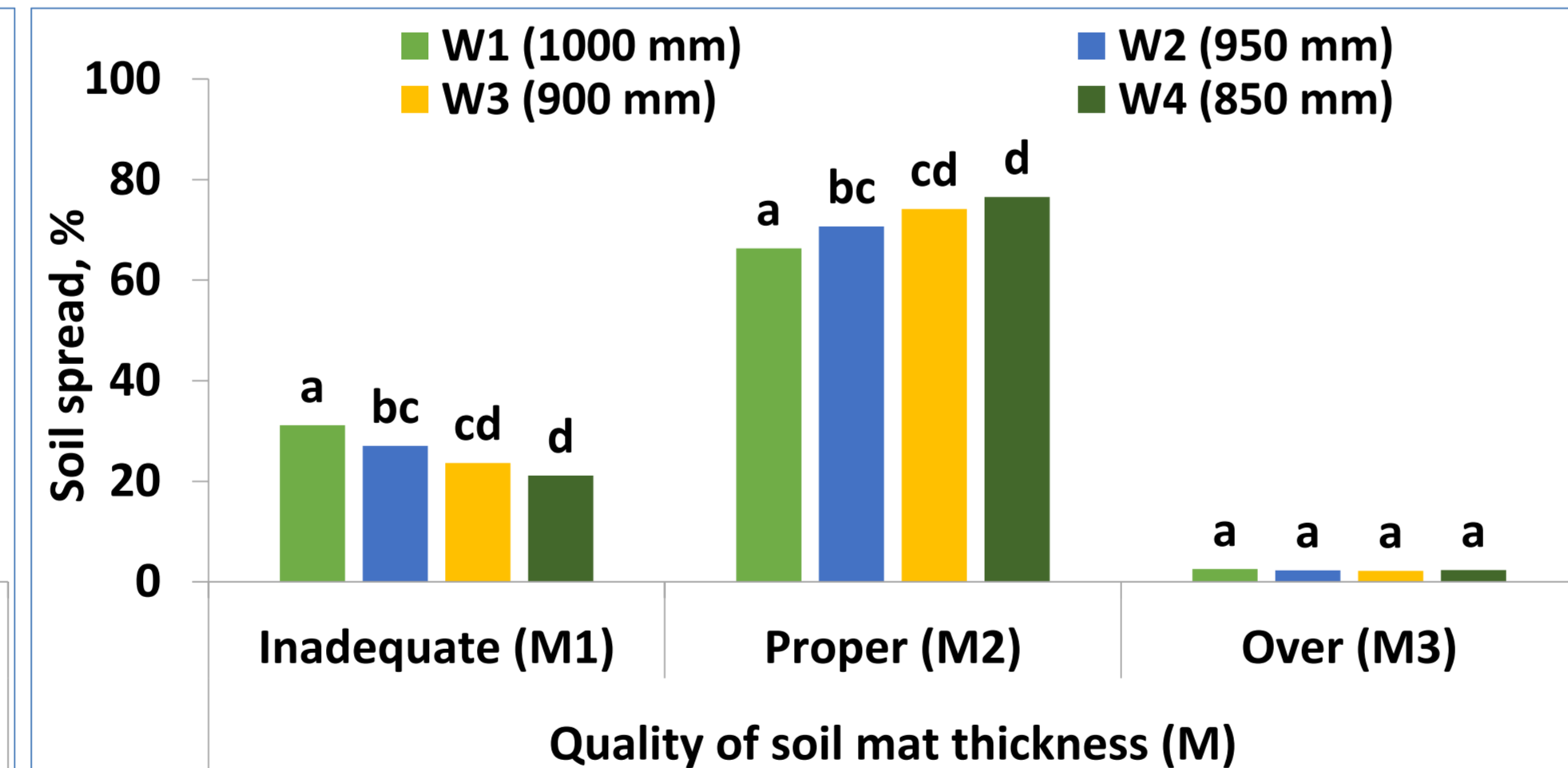
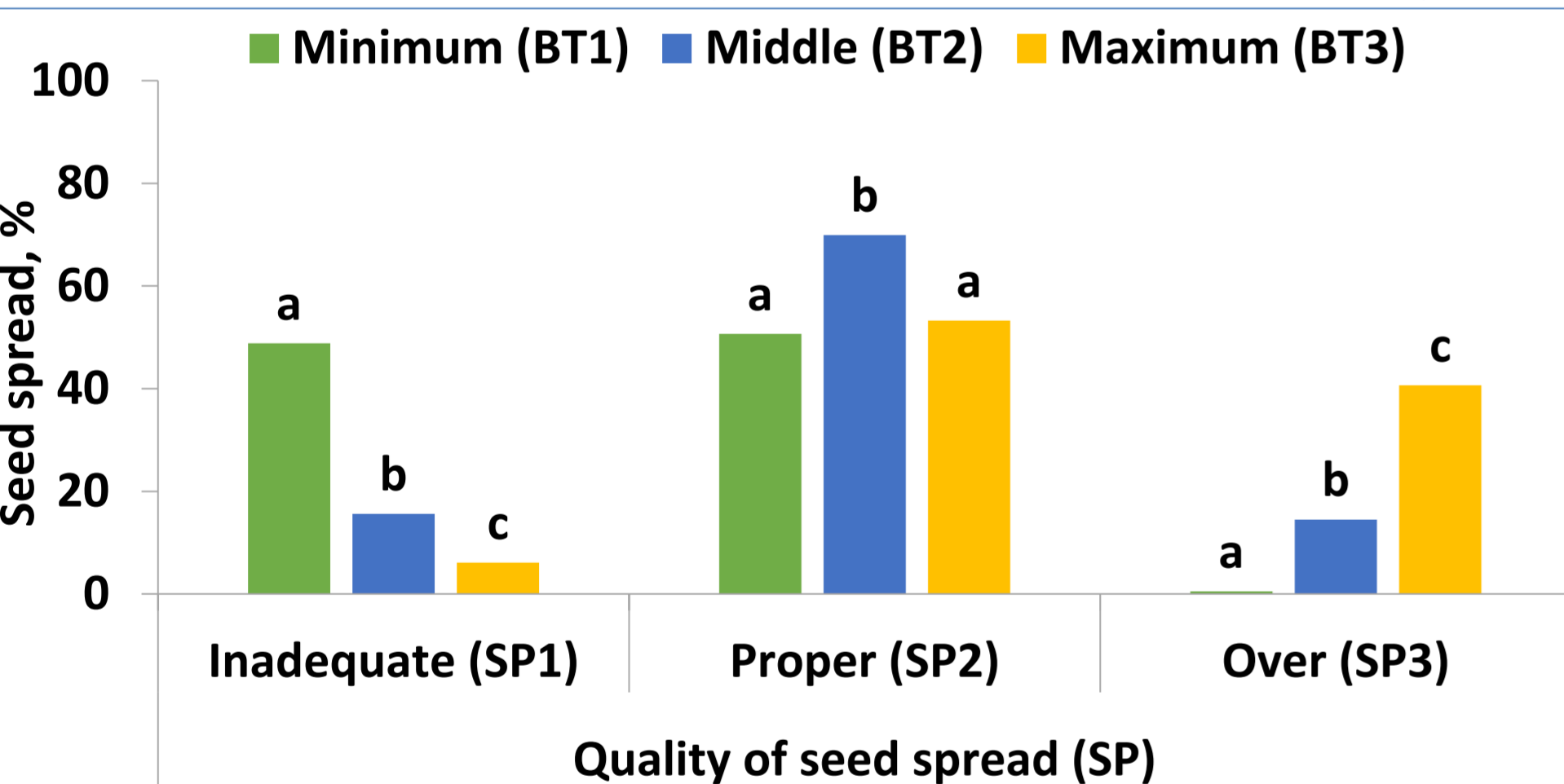
| SN | Dependent Parameter                            | Measurement Remark   |
|----|--|--|
| 1. | Seed spread (SP)                               | Measured at different bites of transplanter cut (BT)<br>Minimum (BT1) Middle (BT2) Maximum (BT3) |
| 2. | Soil spread in terms of soil mat thickness (M) | Measured at different widths of soil bed, mm (W)<br>1000 (W1) 950 (W2) 900 (W3) 850 (W4)         |
| 3. | Pulverization index                            | Measured on prepared soil bed  |
| 4. | Seed damage                                    | Collected after seeding  |
| 5. | Plastic sheet damage                           | After removing soil from the prepared bed  |

| SN | Class of category | Uniformity of seed spread (SP)<br>Number of seeds | Uniformity of soil spread (M)<br>Mat thickness, mm |
|----|-------------------|---|--|
| 1. | Inadequate        | 0-1 (SP1)   | < 20 (M1)  |
| 2. | Proper            | 2-4 (SP2)   | 20-30 (M2)   |
| 3. | Over              | > 4 (SP3)   | > 30 (M3)  |
| 4. | Overall           | ≥ 2 (SP4)   | ≥ 20 (M4)  |

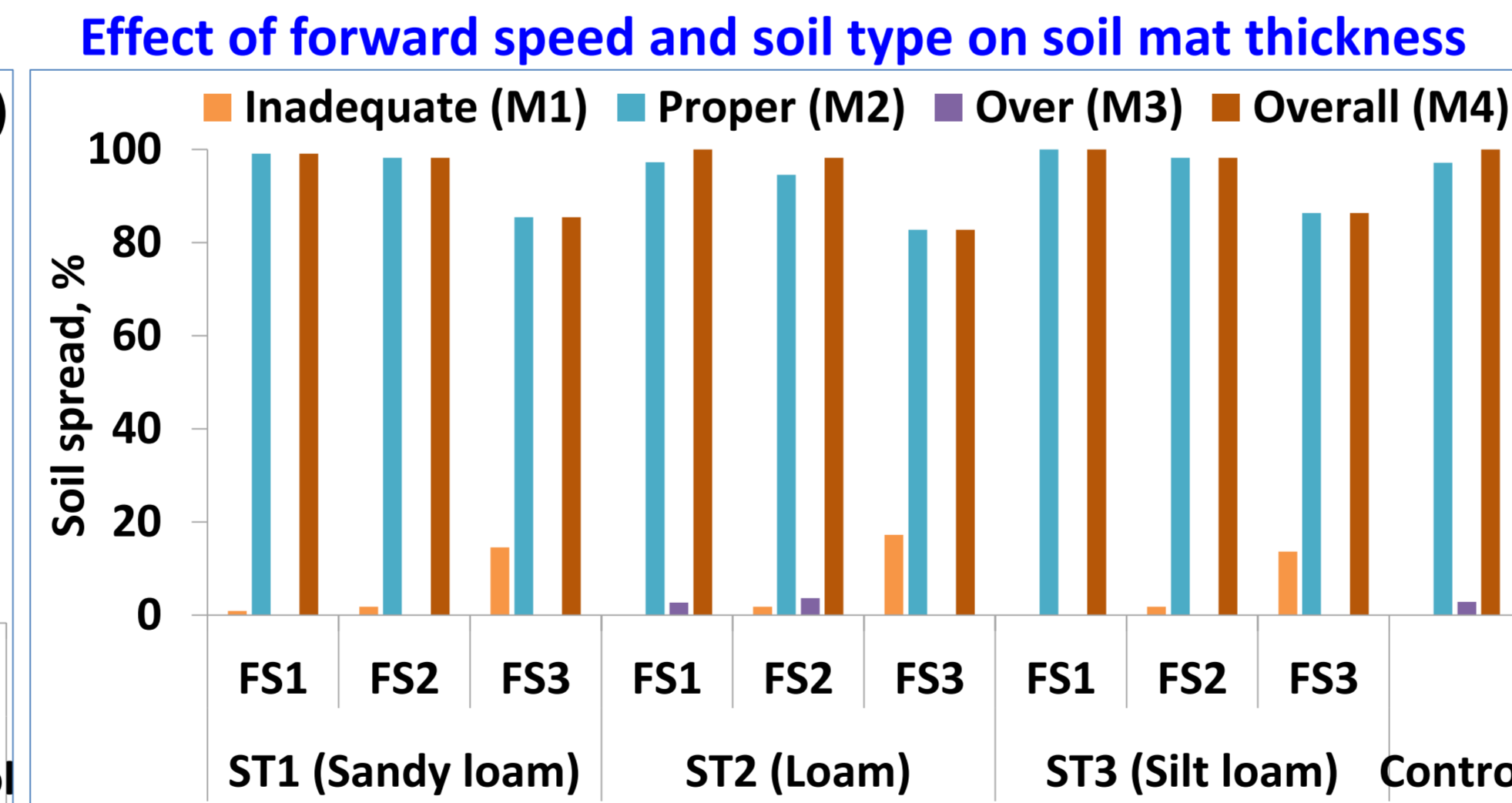
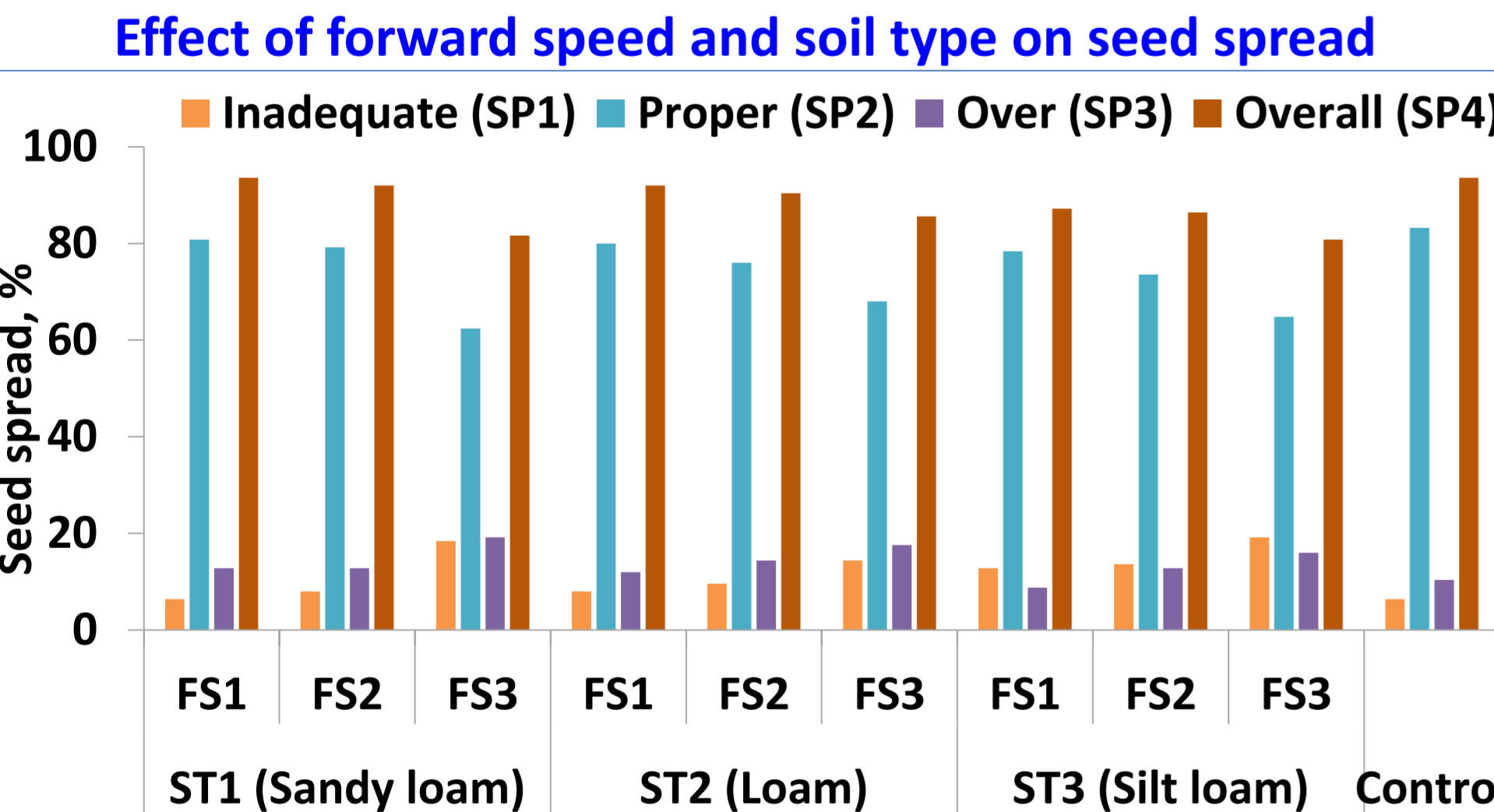


## 3 Results and Discussion

Controlled field evaluation: Selection of best bite of cut and best width of soil bed using machine parameters  
Pooled data for bite of transplanter cut at various seed spread Pooled data for width of soil bed at various soil mat thickness



Actual field evaluation: Selection of best operational parameter



| SN | Selection of best operational parameter based on field evaluation     | Forward speed of the machine, km h <sup>-1</sup> |                    |                    | Control             |
|----|---|--|--------------------|--------------------|---------------------|
|    |   | FS1 (1.7)  | FS2 (2.2)          | FS3 (2.7)          |                     |
| 1. | Overall seed spread (SP4) at middle bite of transplanter cut (BT2), % | 90.93 <sup>a</sup>                               | 89.60 <sup>a</sup> | 82.67 <sup>b</sup> | 90.60 <sup>a</sup>  |
| 2. | Overall soil spread (M4) at 900 mm bed width (W3), %                  | 99.70 <sup>a</sup>                               | 98.18 <sup>a</sup> | 84.85 <sup>b</sup> | 100.00 <sup>a</sup> |
| 3. | Fuel consumption, l h <sup>-1</sup>                                   | 4.36 <sup>a</sup>                                | 4.76 <sup>b</sup>  | 5.11 <sup>c</sup>  | -                   |
| 4. | Actual field capacity, ha h <sup>-1</sup>                             | 0.11 <sup>a</sup>                                | 0.14 <sup>b</sup>  | 0.18 <sup>c</sup>  | 0.001 <sup>d</sup>  |

Note: Operational parameter combination for a particular performance, with same letter are not significantly different (p>0.05)

## 4 Summary

### Controlled field evaluation

- Bites of transplanter cut significantly (p<0.05) affected the quality of seed spread i.e. inadequate, proper, over and overall seed spread.
- Sieve oscillation, sieve opening size and depth of soil cut significantly (p<0.05) affected the dependent parameters namely seed spread, soil spread and pulverization index whereas seed damage and plastic sheet damage were non-significant.
- The higher overall seed spread at the middle bite of transplanter cut was 91.00 % and overall soil mat thickness at 900 mm bed width was 96.97 % corresponding to the best operational parameter combination of sieve oscillations 398 strokes min<sup>-1</sup> (spm), sieve opening size of 25×20 mm and depth of soil cut 80 mm.
- The pulverization index was 2.01 mm whereas, both the seed and plastic sheet damage was negligible.

### Actual field evaluation

- The actual field capacity of the machine was significantly (p<0.05) higher (0.11- 0.18 ha h<sup>-1</sup>) with control (0.001 ha h<sup>-1</sup>) for all the treatment combinations.
- Optimum performance was obtained using sieve oscillations 398 spm, sieve opening size 25 × 20 mm and depth of soil cut 80 mm at a forward speed of 1.7 km h<sup>-1</sup> on all soil types.
- At these operational parameters
  - Overall seed spread = 90.93 %
  - Overall soil spread = 99.70 %
  - Fuel consumption= 4.36 l h<sup>-1</sup>
  - Actual field capacity= 0.11 ha h<sup>-1</sup>
  - Saving in cost of sowing = 87.79 %
  - Labor saving = 96.36 %

## 5 Final Remark(s)

An innovative tractor operated seeder for mat type paddy nursery was designed, developed and evaluated. The machine cuts and convey the soil from both sides, sieve the soil, compact the soil before spreading the polythene sheet, laying polythene sheet, spread the soil of uniform thickness on polythene sheet to make a mat and then sow the seed uniformly on the soil mat in one go. Saving in cost and labor for sowing mat type nursery using mat nursery seeder was observed 87.79 % and 96.36 %, respectively as compared to conventional method. This machine will boost the mechanization in paddy transplanting which enhances the farm mechanization in Indian paddy cultivation. There is a higher demand for the developed technology in the farming community as the trials are being carried out in farmers field at various locations in the state. The patent has been filed (Application No. 202011018197) for the same machine i.e. 'Tractor Operated Seeder for Mat Type Paddy Nursery' at Patent Office, New Delhi, India.