**Integrated Nutrient Management in Potato-Baby corn Cropping Sequence and Its Impact on Soil Quality and Yield**

**Abstract**

 The present studyaimed to evaluate theintegrated nutrient management in potato-baby corn cropping sequence and its impact on soil quality and yield**.** A field experiment was conducted during the rabi and summer seasons of 2016–17 and 2017–18 at the Instructional-cum-Research Farm of Assam Agricultural University, Jorhat. The experiment included sixteen treatments incorporating various nutrient combinations, such as 100% of the recommended dose (RD) of nitrogen (N) and different proportions of RD N supplemented with organic sources like farmyard manure (FYM), poultry manure, vermicompost, and enriched compost. Implemented in a randomized block design with three replications, the soil at the experimental site had a sandy loam texture, an acidic pH of 5.57, medium organic carbon content (0.75%), and moderate availability of N (292 kg/ha), P₂O₅ (25.80 kg/ha), and K₂O (272.18 kg/ha). The total rainfall recorded during the cropping sequence was 2336.40 mm in 2016–17 and 2107.10 mm in 2017–18, with temperatures ranging from 8.0°C to 35.1°C during both years. The results revealed that the treatment T₆ (50% RD N + 25% N through FYM + 25% N through vermicompost) achieved the highest growth and yield attributes for both potato and baby corn. In the case of potato, this treatment recorded the highest tuber yield over two years (27.77 t/ha). Similarly, for baby corn, T₆ resulted in the highest cob yield with husk (23.09 t/ha in 2016–17 and 24.83 t/ha in 2017–18). The integrated nutrient management (INM) practices implemented in the study significantly enhanced the soil quality of the experimental site. Among the treatments, T₆ (50% RD N + 25% N through FYM + 25% N through vermicompost) proved most effective in improving both the physico-chemical and biological properties of the soil. Post-cropping, this treatment recorded higher organic carbon content (0.98% in 2016–17 and 1.02% in 2017–18), indicating improved soil organic matter and enhanced microbial activity. Moreover, the availability of essential nutrients—nitrogen (391.33 and 423.33 kg/ha), phosphorus (28.88 and 29.50 kg/ha), and potassium (336.55 and 347.90 kg/ha)—increased noticeably under T₆, suggesting better nutrient retention and soil fertility. The improvement in soil microbial biomass carbon further highlights the positive impact of INM on biological soil health, ultimately contributing to the sustainability and productivity of the potato-baby corn cropping sequence.Economically, T6 emerged as the most profitable practice, generating a net return of Rs 6,38,200.00 per hectare and a benefit-cost ratio (B:C) of 4.82 in the potato-baby corn cropping sequence. These findings establish the superiority of the 50% RD N + 25% N through FYM + 25% N through vermicompost (T6) treatment in enhancing crop growth, soil health, economic yield, and overall system productivity in this cropping sequence.

Keywords: *Babycorn, Enriched compost, Integrated Nutrient Management, Potato, Vermicompost*

1. **Introduction**

“The potato, often hailed as the "King of Vegetables," is the third most important food crop globally, following rice and wheat” (Khurana and Naik, 2003). Its popularity in China and India, which together contribute 38% of global production, has driven its expansion (Kumar et al., 2017). In India, potato production increased from 34.7 million metric tons (MT) in 2008 to 50.19 million MT in 2019, a 45% rise over a decade, with a projected annual growth rate of 3% until 2050 (ICAR CPRI Shimla). Potatoes are rich in starch, vitamins B and C, and essential amino acids, making them nutritionally significant. However, Assam lags behind the national average in productivity (7.5 t/ha) due to a lack of quality tubers, pest issues, and rainfed cultivation (Kumar et al., 2024).

Similarly, maize, known as the "Queen of Cereals," is the third most cultivated cereal and plays a crucial role in food, feed, and industry (Navarre et al., 2019; Islam et al., 2013). The introduction of baby corn, harvested young for vegetable use, offers high economic potential due to its short growth cycle (60–70 days) and high fodder yield. India’s low labour costs provide an advantage in manual harvesting, a practice common in top baby corn-exporting nations like Thailand, China, and Sri Lanka. Its increasing demand in Asia, Africa, and South America highlights its economic importance and potential for higher returns. (Dass *et al.,* 2004; Ghosh, 2014).

**2. Methods and Materials**

2.1 Experimental Design and Layout

The experiment was conducted at the AICRP (Potato) field, ICR Farm using a Randomized Block Design (RBD) with three replications and sixteen treatments, resulting in 48 plots. The total experimental area was 432 m² (24m × 18m), with individual plots measuring 3m × 3m. The tested varieties were Kufri Pukhraj (potato) and G 5414 (baby corn).

2.2 Rainfall

The total rainfall received during the cropping sequence of 2016-17 was 2336.40 mm in 129 rainy days. In 2017-18 cropping sequence the total rainfall received was recorded 2107.10 mm in 127rainy day.

2.3 Treatment Details

The experiment included combinations of organic and inorganic fertilizers:

* T1: 100% RD of N
* T2-T5: 75% RD of N + 25% N from FYM, poultry manure, vermicompost, or enriched compost
* T6-T8: 50% RD of N + 25% N from one organic source + 25% from another
* T9-T12: 50% RD of N + 50% N from a single organic source
* T13-T16: 50% RD of N + 25% N from a single organic source

2.4 Crop Management

Potato (Kufri Pukhraj):

* Tuber traits: Early bulking, ovoid yellow tubers with medium deep eyes
* Resistance: Early blight (resistant), late blight (moderately resistant)
* Duration: 70–90 days
* Yield: 250–400 q/ha

Baby Corn (G 5414):

* Harvest: First harvest at 49–55 days, 2–3 cobs per plant

2.5 Fertilizer and Biofertilizer Application

* Organic Manures (FYM, poultry manure, vermicompost, enriched compost): Applied at planting/sowing.
* Biofertilizers: Tubers coated before planting.

2.6 Planting and Spacing

* Potato: 22.5 q/ha, 50 cm × 20 cm spacing, manually planted (26th & 29th Nov), irrigated thrice.
* Baby Corn: 25 kg/ha, 60 cm × 20 cm spacing, sown on 12th April & 28th March.

2.7 Chemical parameters

 Soil pH

 Soil pH was determined before planting and at harvest by glass electrode method (Jackson, 1973). For the purpose, soil water suspension was prepared at the ratio of 1: 2.5 and the pH of the suspension was determined with pH meters with glass electrode.

Organic carbon

 Organic Carbon in the soil (0.2g) was oxidized with a mixture of 1N K2Cr2O7 (Potassium dichromate), conc. H2SO4 (sulphuric acid) and conc. H3PO4 (Ortho phosphoric acid) for reduction of K2Cr2O7 by organic compounds as per the method described by Walkley (1947). The unused K2Cr2O7 was back titrated with ferrous ammonium sulphate (FAS) [(NH4)2 SO4 FeSO4 6H2O] (0.5M) using diphenylamine indicator till the colour changed from violet blue to green. Blank contained no soil but all reagents treated similarly for calculation.

Available nitrogen

 Available N of the soil sample was estimated by modified Kjeldalh’s method as described by Jackson (1973) and expressed as kg ha-1.

Available phosphorous

 Available P in soil sample was extracted by Bray’s method as outlined by Jackson (1973). The phosphorous content was determined with the help of Spectrophotometer and expressed as available P2O5 (kg ha-1).

Available potassium

 Available K content of the soil sample was extracted with neutral normal ammonium acetate as outlined by Jackson (1973). The potassium content was determined with the help of Flame Photometer and expressed as available K2O (kg ha-1).

2.8 Data Collection and Analysis

* The harvested tubers were sorted out into four different grades viz., <25g, 25-50g, 50-75g and >75g. The weight of each grade of tubers per plot was recorded in kilogram and later converted into t/ha. Similarly the total tuber yield per plot was recorded in kilogram and later converted into t/ha.
* The uptake of nutrients was calculated by multiplying the concentration of the nutrients in the tuber and haulm samples with the corresponding yields of tuber and haulm of the potato.

Nutrients Uptake (Kg/ ha) **=** 

* Microbial Biomass Carbon (MBC): Assessed via chloroform fumigation-extraction, using MBC (μg g⁻¹) = Ec/KEC.

 Microbial biomass carbon was determined by chloroform fumigation- extraction technique following the method of Vance et al. (1987). 5g soils in 50ml glass beaker are placed in a desiccator and a vial of soda lime. A beaker containing 50 ml ethanol free CHCl3 (chloroform) and the desiccators evacuated until the CHCl3 has boiled vigorously for 2 minutes. The desiccator was then incubated in dark at 25°C for 24 hours. After fumigation, CHCl3 was removed by repeated evacuation, the soils were then extracted with 25ml 0.05M K2SO4 (5:1) for 30 minutes by oscillating shaking at 200 rpm and then filtered through a Whatman No. 42 filter paper. Controls were prepared by extracting soils without fumigation. Organic carbon content in the extracts was measured with dichromate (66.7mM) digestion method. To 8ml of extract in a 250ml conical flask, 2ml of K2Cr2O7 (66.7mM) and 15ml of the digestion mixture (2:1 conc. H2SO4: H3PO4 (v/v)) was added. The mixture was gently refluxed for 30 minutes, allowed to cool and diluted with 20 ml distilled water. The excess K2Cr2O7 was measured by back titration with FAS (40.0mM) using 1.10-phenanthroline-ferrous sulphate complex (25mM) solution as an indicator. MBC was calculated from the differences in extractable organic carbon between the fumigated and non fumigated soil and expressed as μg g-1 on dry weight basis as follows:

 MBC (μg g-1) = Ec/KEC

Where, Ec = [(OC extracted from fumigated soil) – (OC extracted from non fumigated soil)] KEC = 0.38 (Vance et al., 1987)

* 1. **Results and Discussion**

The results indicated that different INM treatments significantly influenced grade-wise tuber yield (Table 1). The highest tuber yield across all grades was recorded in T6 (50% RD of N + 25% N through FYM + 25% N through vermicompost), followed by T8. The increased yield can be attributed to improved soil mineralization, enhanced nutrient availability, and the synergistic effect of biofertilizers with organic sources, supporting findings by Singh *et al.* (2005).Total tuber yield (Table 2) followed a similar trend, with T6 recording the highest yield of 30.31 t/ha and 25.23 t/ha during both years, followed by T8 (23.04 t/ha. The maximum increase in tuber yield at T6 could be due to the balance supply of nitrogen through INM and its uptake by the plants might have stimulated the rate of various physiological processes in plant and lead to increased growth and tuber yield. Similar findings of Islam *et al*. (2013) also support “the effect of organic manure and chemical fertilizers in combination on soil properties and enhancement of tuber yield. These results could also be attributed to balanced nutrition of the crop particularly in respect to N, P, and K owing to integrated use of organic and inorganic fertilizer. The key role of nitrogen, phosphorous and potassium on tuber initiation, growth and development were established by several researchers” (De, 1960; Sharma and Sharma, 1990; Grewal *et al.,* 1991; Lal and Arora, 1994). Nutrient uptake by both the haulm and tuber was significantly affected by INM (Tables 3–8). T6 consistently recorded the highest N, P, and K uptake, followed by T8. The increased uptake in T6 is likely due to improved vegetative growth, root development, and better nutrient assimilation. Similarly, in the case of baby corn, the highest cob yield was recorded in T6 (23.09 t/ha with husk, 9.39 t/ha without husk), followed by T8, reflecting the beneficial impact of integrated nutrient management on crop productivity (Tables 9 & 10).

“Soil health parameters were also positively influenced by INM treatments. T6 exhibited the highest organic carbon content (0.98–1.02%) and microbial biomass carbon, indicating improved soil fertility and microbial activity. Increased soil biomass carbon in INM treated plots might be due to effect of application of organic manures along with bio-fertilizer and inorganic fertilizers in the soil. The application of organic manures which contains crop residues, animal faeces and their compost etc. in soil usually increases the soil biomass and activities” (Subhani *et al.,* 2001).Furthermore, T6 provided the highest net return of Rs. 6,38,200/ha and a benefit-cost ratio (B:C) of 4.82, making it the most economically viable treatment.

Overall, T6 (50% RD of N + 25% N through FYM + 25% N through vermicompost) emerged as the best INM practice, leading to higher crop productivity, enhanced nutrient uptake, improved soil fertility, and better economic returns. These findings highlight the potential of integrated nutrient management as a sustainable approach for maintaining soil health and boosting agricultural productivity.

**Table1. Influence of different INM practices on grade wise tuber yield of potato**

|  |  |
| --- | --- |
| **Treatments** | **Grade wise tuber yield (t/ha)** |
| **<25g** | **25-50g** | **50-75g** | **>75g** |
| **2016-17** | **2017-18** | **2016-17** | **2017-18** | **2016-17** | **2017-18** | **2016-17** | **2017-18** |
| T1 : 100% RD of N | 3.96 | 3.25 | 5.28 | 4.62 | 6.15 | 5.18 | 5.53 | 3.57 |
| T2: 75% RD of N + 25% N through FYM | 4.14 | 3.23 | 5.72 | 4.27 | 6.35 | 6.87 | 6.05 | 3.95 |
| T3: 75% RD of N + 25% N through poultry manure | 4.11 | 3.24 | 5.12 | 4.45 | 6.27 | 6.87 | 5.52 | 4.06 |
| T4: 75% RD of N +25% N through vermicompost | 3.60 | 2.18 | 4.43 | 4.05 | 6.95 | 6.59 | 5.76 | 4.06 |
| T5: 75% RD of N + 25% N through enriched compost | 3.21 | 2.27 | 5.24 | 5.24 | 7.43 | 5.60 | 6.24 | 3.72 |
| T6: 50% RD of N + 25% N through FYM +25% N through vermicompost | 5.51 | 4.54 | 6.94 | 6.98 | 9.82 | 8.60 | 8.04 | 5.14 |
| T7: 50% RD of N + 25% N through poultry manure + 25% N through enriched compost | 3.35 | 3.08 | 5.04 | 5.19 | 7.65 | 6.81 | 6.31 | 3.90 |
| T8: 50% RD of N + 25% N through FYM + 25% N through poultry manure | 4.57 | 3.33 | 5.99 | 5.78 | 7.68 | 7.08 | 7.39 | 4.25 |
| T9: 50% RD of N + 50% N through FYM | 2.63 | 3.05 | 5.72 | 5.49 | 5.48 | 5.70 | 5.06 | 4.18 |
| T10: 50% RD of N + 50% N through poultry manure | 4.53 | 3.23 | 4.17 | 5.19 | 6.47 | 6.40 | 6.41 | 4.05 |
| T11: 50% RD of N + 25% N through poultry manure | 3.77 | 3.02 | 5.09 | 4.88 | 4.87 | 5.60 | 6.34 | 3.65 |
| T12: 50% RD of N + 50% N through vermicompost | 3.93 | 2.18 | 4.96 | 5.96 | 5.96 | 6.15 | 5.72 | 3.80 |
| T13: 50% RD of N + 25% N through FYM | 3.21 | 1.96 | 5.15 | 4.95 | 5.28 | 5.60 | 5.44 | 4.16 |
| T14: 50% RD of N + 25% N through poultry manure | 2.81 | 3.37 | 4.95 | 4.17 | 5.19 | 5.43 | 5.61 | 3.82 |
| T15: 50% RD of N + 25% N through vermicompost | 4.01 | 1.93 | 4.29 | 4.29 | 4.29 | 5.65 | 5.18 | 3.77 |
| T16: 50% RD of N + 25% N through enriched compost | 4.37 | 2.96 | 5.50 | 5.48 | 7.35 | 6.29 | 4.76 | 3.49 |
| S.Em(±) | 0.29 | 0.37 | 0.57 | 0.56 | 0.70 | 0.49 | 0.59 | 0.27 |
| CD(p=0.05) | 0.85 | 1.07 | NS | NS | 2.02 | 1.41 | 1.72 | NS |

INM-Integrated nutrient management, NS – Non-significant

**Table 2. Influence of different INM practices on tuber yield of potato**

|  |  |
| --- | --- |
| **Treatments** | **Total tuber yield (t/ha)** |
| **2016-17** | **2017-18** | **Pooled** |
| T1 : 100% RD of N | 20.92 | 16.62 | 18.77 |
| T2: 75% RD of N + 25% N through FYM | 22.26 | 18.32 | 20.29 |
| T3: 75% RD of N + 25% N through poultry manure | 21.02 | 18.62 | 19.83 |
| T4: 75% RD of N +25% N through vermicompost | 20.74 | 16.88 | 18.80 |
| T5: 75% RD of N + 25% N through enriched compost | 22.12 | 16.83 | 19.47 |
| T6: 50% RD of N + 25% N through FYM +25% N through vermicompost | 30.31 | 25.23 | 27.77 |
| T7: 50% RD of N + 25% N through poultry manure + 25% N through enriched compost | 22.35 | 18.98 | 20.66 |
| T8: 50% RD of N + 25% N through FYM + 25% N through poultry manure | 25.64 | 20.44 | 23.04 |
| T9: 50% RD of N + 50% N through FYM | 18.89 | 18.42 | 18.64 |
| T10: 50% RD of N + 50% N through poultry manure | 21.58 | 18.87 | 20.22 |
| T11: 50% RD of N + 25% N through poultry manure | 20.08 | 17.15 | 18.61 |
| T12: 50% RD of N + 50% N through vermicompost | 20.57 | 18.09 | 19.33 |
| T13: 50% RD of N + 25% N through FYM | 19.08 | 16.67 | 17.87 |
| T14: 50% RD of N + 25% N through poultry manure | 18.56 | 16.79 | 17.67 |
| T15: 50% RD of N + 25% N through vermicompost | 17.78 | 15.64 | 16.71 |
| T16: 50% RD of N + 25% N through enriched compost | 21.98 | 18.22 | 20.10 |
| S.Em(±) | 0.53 | 0.86 | 0.83 |
| CD(P=0.05) | 1.53 | 2.48 | 1.68 |

 INM- Integrated nutrient management

**Table3. Influence of different INM practices on nitrogen uptake by haulm of potato**

|  |  |
| --- | --- |
| **Treatments** | **N (kg/ha)** |
| **2016-17** | **2017-18** |
| T1 : 100% RD of N | 18.86 | 16.40 |
| T2: 75% RD of N + 25% N through FYM | 16.09 | 15.79 |
| T3: 75% RD of N + 25% N through poultry manure | 15.48 | 15.51 |
| T4: 75% RD of N +25% N through vermicompost | 15.90 | 15.67 |
| T5: 75% RD of N + 25% N through enriched compost | 16.52 | 16.67 |
| T6: 50% RD of N + 25% N through FYM +25% N through vermicompost | 23.88 | 24.05 |
| T7: 50% RD of N + 25% N through poultry manure + 25% N through enriched compost | 16.84 | 17.50 |
| T8: 50% RD of N + 25% N through FYM + 25% N through poultry manure | 20.60 | 20.82 |
| T9: 50% RD of N + 50% N through FYM | 14.90 | 15.01 |
| T10: 50% RD of N + 50% N through poultry manure | 17.46 | 16.37 |
| T11: 50% RD of N + 25% N through poultry manure | 16.89 | 17.47 |
| T12: 50% RD of N + 50% N through vermicompost | 17.67 | 17.73 |
| T13: 50% RD of N + 25% N through FYM | 16.53 | 16.76 |
| T14: 50% RD of N + 25% N through poultry manure | 15.93 | 16.68 |
| T15: 50% RD of N + 25% N through vermicompost | 16.48 | 16.58 |
| T16: 50% RD of N + 25% N through enriched compost | 16.77 | 17.12 |
| S.Em(±) | 0.92 | 0.66 |
| CD(P=0.05) | 2.67 | 1.91 |

INM-Integrated nutrient management

**Table 4. Influence of different INM practices on phosphorous uptake by haulm of potato**

|  |  |
| --- | --- |
| **Treatments** | **P (kg/ha)** |
| **2016-17** | **2017-18** |
| T1 : 100% RD of N | 4.82 | 4.23 |
| T2: 75% RD of N + 25% N through FYM | 4.29 | 3.99 |
| T3: 75% RD of N + 25% N through poultry manure | 4.19 | 4.10 |
| T4: 75% RD of N +25% N through vermicompost | 4.28 | 4.03 |
| T5: 75% RD of N + 25% N through enriched compost | 4.45 | 3.97 |
| T6: 50% RD of N + 25% N through FYM +25% N through vermicompost | 6.55 | 6.59 |
| T7: 50% RD of N + 25% N through poultry manure + 25% N through enriched compost | 4.32 | 4.15 |
| T8: 50% RD of N + 25% N through FYM + 25% N through poultry manure | 4.87 | 4.52 |
| T9: 50% RD of N + 50% N through FYM | 4.65 | 3.83 |
| T10: 50% RD of N + 50% N through poultry manure | 4.25 | 4.08 |
| T11: 50% RD of N + 25% N through poultry manure | 4.59 | 4.49 |
| T12: 50% RD of N + 50% N through vermicompost | 4.47 | 4.44 |
| T13: 50% RD of N + 25% N through FYM | 4.57 | 4.38 |
| T14: 50% RD of N + 25% N through poultry manure | 4.30 | 4.27 |
| T15: 50% RD of N + 25% N through vermicompost | 4.28 | 4.20 |
| T16: 50% RD of N + 25% N through enriched compost | 4.40 | 4.34 |
| S.Em(±) | 0.29 | 0.20 |
| CD(P=0.05) | 0.85 | 0.59 |

INM-Integrated nutrient management

**Table5. Influence of different INM practices on potassium uptake by haulm of potato**

|  |  |
| --- | --- |
| **Treatment** | **K (kg/ha)** |
| **2016-17** | **2017-18** |
| T1 : 100% RD of N | 9.93 | 9.21 |
| T2: 75% RD of N + 25% N through FYM | 9.33 | 9.02 |
| T3: 75% RD of N + 25% N through poultry manure | 9.00 | 8.96 |
| T4: 75% RD of N +25% N through vermicompost | 9.58 | 9.32 |
| T5: 75% RD of N + 25% N through enriched compost | 9.88 | 9.94 |
| T6: 50% RD of N + 25% N through FYM +25% N through vermicompost | 13.98 | 14.05 |
| T7: 50% RD of N + 25% N through poultry manure + 25% N through enriched compost | 9.54 | 9.45 |
| T8: 50% RD of N + 25% N through FYM + 25% N through poultry manure | 11.35 | 10.73 |
| T9: 50% RD of N + 50% N through FYM | 8.21 | 8.19 |
| T10: 50% RD of N + 50% N through poultry manure | 9.45 | 8.92 |
| T11: 50% RD of N + 25% N through poultry manure | 9.75 | 9.63 |
| T12: 50% RD of N + 50% N through vermicompost | 10.00 | 9.97 |
| T13: 50% RD of N + 25% N through FYM | 9.65 | 9.64 |
| T14: 50% RD of N + 25% N through poultry manure | 9.04 | 9.00 |
| T15: 50% RD of N + 25% N through vermicompost | 9.15 | 8.69 |
| T16: 50% RD of N + 25% N through enriched compost | 9.12 | 9.03 |
| S.Em(±) | 0.56 | 0.28 |
| CD(P=0.05) | 1.61 | 0.82 |

INM-Integrated nutrient management

**Table 6. Influence of different INM practices on nitrogen uptake by tuber of potato**

|  |  |
| --- | --- |
| **Treatments** | **N (kg/ha)** |
| **2016-17** | **2017-18** |
| T1 : 100% RD of N | 55.02 | 52.77 |
| T2: 75% RD of N + 25% N through FYM | 44.61 | 41.53 |
| T3: 75% RD of N + 25% N through poultry manure | 42.43 | 40.10 |
| T4: 75% RD of N +25% N through vermicompost | 52.66 | 50.52 |
| T5: 75% RD of N + 25% N through enriched compost | 42.03 | 41.54 |
| T6: 50% RD of N + 25% N through FYM +25% N through vermicompost | 76.88 | 72.33 |
| T7: 50% RD of N + 25% N through poultry manure + 25% N through enriched compost | 44.64 | 43.33 |
| T8: 50% RD of N + 25% N through FYM + 25% N through poultry manure | 60.84 | 58.71 |
| T9: 50% RD of N + 50% N through FYM | 50.43 | 46.55 |
| T10: 50% RD of N + 50% N through poultry manure | 53.61 | 41.57 |
| T11: 50% RD of N + 25% N through poultry manure | 47.41 | 43.51 |
| T12: 50% RD of N + 50% N through vermicompost | 46.57 | 44.38 |
| T13: 50% RD of N + 25% N through FYM | 48.66 | 41.51 |
| T14: 50% RD of N + 25% N through poultry manure | 43.53 | 42.83 |
| T15: 50% RD of N + 25% N through vermicompost | 47.46 | 41.47 |
| T16: 50% RD of N + 25% N through enriched compost | 51.10 | 43.23 |
| S.Em(±) | 3.71 | 3.54 |
| CD(P=0.05) | 10.72 | 10.21 |

INM-Integrated nutrient management

**Table 7. Influence of different INM practices on phosphorous uptake by tuber of potato**

|  |  |
| --- | --- |
| **Treatments** | **P (kg/ha)** |
| **2016-17** | **2017-18** |
| T1 : 100% RD of N | 14.06 | 13.34 |
| T2: 75% RD of N + 25% N through FYM | 11.29 | 10.59 |
| T3: 75% RD of N + 25% N through poultry manure | 11.27 | 10.59 |
| T4: 75% RD of N +25% N through vermicompost | 13.22 | 12.93 |
| T5: 75% RD of N + 25% N through enriched compost | 10.78 | 10.60 |
| T6: 50% RD of N + 25% N through FYM +25% N through vermicompost | 20.36 | 19.94 |
| T7: 50% RD of N + 25% N through Poultry manure + 25% N through enriched compost | 11.27 | 11.09 |
| T8: 50% RD of N + 25% N through FYM + 25% N through poultry manure | 15.64 | 15.60 |
| T9: 50% RD of N + 50% N through FYM | 12.41 | 12.05 |
| T10: 50% RD of N + 50% N through poultry manure | 10.99 | 10.18 |
| T11: 50% RD of N + 25% N through poultry manure | 10.74 | 10.62 |
| T12: 50% RD of N + 50% N through vermicompost | 11.51 | 11.49 |
| T13: 50% RD of N + 25% N through FYM | 10.86 | 10.48 |
| T14: 50% RD of N + 25% N through poultry manure | 10.08 | 10.00 |
| T15: 50% RD of N + 25% N through vermicompost | 11.64 | 11.21 |
| T16: 50% RD of N + 25% N through enriched compost | 12.09 | 11.61 |
| S.Em(±) | 1.15 | 0.93 |
| CD(P=0.05) | 3.33 | 2.70 |

INM-Integrated nutrient management

**Table 8. Influence of different INM practices on potassium uptake by tuber of potato**

|  |  |
| --- | --- |
| **Treatments** | **K (kg/ha)** |
| **2016-17** | **2017-18** |
| T1 : 100% RD of N | 42.25 | 39.92 |
| T2: 75% RD of N + 25% N through FYM | 36.52 | 34.13 |
| T3: 75% RD of N + 25% N through poultry manure | 35.59 | 33.47 |
| T4: 75% RD of N +25% N through vermicompost | 42.23 | 41.24 |
| T5: 75% RD of N + 25% N through enriched compost | 33.83 | 33.06 |
| T6: 50% RD of N + 25% N through FYM +25% N through vermicompost | 60.32 | 56.72 |
| T7: 50% RD of N + 25% N through poultry manure + 25% N through enriched compost | 40.40 | 37.05 |
| T8: 50% RD of N + 25% N through FYM + 25% N through poultry manure | 48.43 | 47.79 |
| T9: 50% RD of N + 50% N through FYM | 40.14 | 38.09 |
| T10: 50% RD of N + 50% N through poultry manure | 39.09 | 34.07 |
| T11: 50% RD of N + 25% N through poultry manure | 38.62 | 35.68 |
| T12: 50% RD of N + 50% N through vermicompost | 38.65 | 35.75 |
| T13: 50% RD of N + 25% N through FYM | 37.37 | 34.03 |
| T14: 50% RD of N + 25% N through poultry manure | 37.30 | 32.68 |
| T15: 50% RD of N + 25% N through vermicompost | 38.03 | 34.84 |
| T16: 50% RD of N + 25% N through enriched compost | 40.60 | 36.05 |
| S.Em(±) | 2.55 | 2.85 |
| CD(P=0.05) | 7.35 | 8.22 |

INM-Integrated nutrient management

**Table 9. Influence of different INM practices on cob yield with husk**

|  |  |
| --- | --- |
| **Treatments** | **Cob yield with husk (t/ha)** |
| **2016-17** | **2017-18** |
| T1 : 100% RD of N | 12.67 | 8.20 |
| T2: 75% RD of N + 25% N through FYM | 14.48 | 9.83 |
| T3: 75% RD of N + 25% N through poultry manure | 13.19 | 17.24 |
| T4: 75% RD of N +25% N through vermicompost | 11.64 | 12.72 |
| T5: 75% RD of N + 25% N through enriched compost | 11.70 | 14.19 |
| T6: 50% RD of N + 25% N through FYM +25% N through vermicompost | 23.09 | 24.83 |
| T7: 50% RD of N + 25% N through poultry manure + 25% N through enriched compost | 11.46 | 19.35 |
| T8: 50% RD of N + 25% N through FYM + 25% N through poultry manure | 18.81 | 21.07 |
| T9: 50% RD of N + 50% N through FYM | 13.84 | 17.45 |
| T10: 50% RD of N + 50% N through poultry manure | 13.71 | 12.71 |
| T11: 50% RD of N + 25% N through poultry manure | 10.95 | 10.85 |
| T12: 50% RD of N + 50% N through vermicompost | 16.44 | 16.02 |
| T13: 50% RD of N + 25% N through FYM | 13.50 | 14.72 |
| T14: 50% RD of N + 25% N through poultry manure | 14.28 | 16.60 |
| T15: 50% RD of N + 25% N through vermicompost | 11.70 | 8.35 |
| T16: 50% RD of N + 25% N through enriched compost | 15.30 | 19.23 |
| S.Em(±) | 1.17 | 0.93 |
| CD(P=0.05) | 3.38 | 2.68 |

 INM-Integrated nutrient management

**Table10. Influence of different INM practices on cob yield without husk**

|  |  |
| --- | --- |
| **Treatments** | **Cob yield without husk (t/ha)** |
| **2016-17** | **2017-18** | **Pooled** |
| T1 : 100% RD of N | 5.81 | 4.95 | 5.38 |
| T2: 75% RD of N + 25% N through FYM | 7.07 | 4.83 | 5.95 |
| T3: 75% RD of N + 25% N through poultry manure | 4.99 | 5.90 | 5.45 |
| T4: 75% RD of N +25% N through vermicompost | 6.02 | 5.27 | 5.64 |
| T5: 75% RD of N + 25% N through enriched compost | 5.42 | 5.25 | 5.33 |
| T6: 50% RD of N + 25% N through FYM +25% N through vermicompost | 8.38 | 9.40 | 9.39 |
| T7: 50% RD of N + 25% N through poultry manure + 25% N through enriched compost | 5.90 | 5.19 | 5.55 |
| T8: 50% RD of N + 25% N through FYM + 25% N through poultry manure | 7.45 | 7.65 | 7.55 |
| T9: 50% RD of N + 50% N through FYM | 4.58 | 5.23 | 4.91 |
| T10: 50% RD of N + 50% N through poultry manure | 5.12 | 5.22 | 5.17 |
| T11: 50% RD of N + 25% N through poultry manure | 5.37 | 5.01 | 5.19 |
| T12: 50% RD of N + 50% N through vermicompost | 4.38 | 5.50 | 4.94 |
| T13: 50% RD of N + 25% N through FYM | 4.98 | 4.82 | 4.90 |
| T14: 50% RD of N + 25% N through poultry manure | 4.13 | 5.04 |  4.58 |
| T15: 50% RD of N + 25% N through vermicompost | 5.26 | 5.90 | 5.58 |
| T16: 50% RD of N + 25% N through enriched compost | 5.28 | 5.13 | 5.20 |
| S.Em(±) | 0.64 | 0.58 | 0.61 |
| CD(P=0.05) | 1.85 | 1.69 |  1.23 |

 INM- Integrated nutrient management

**Table 11. Influence of different INM practices on soil microbial biomass carbon**

|  |  |
| --- | --- |
| **Treatments** | **MBC (µg g-1 soil)** |
| **2016-17** | **2017-18** |
| T1 : 100% RD of N | 243.88 | 249.11 |
| T2: 75% RD of N + 25% N through FYM | 300.53 | 305.90 |
| T3: 75% RD of N + 25% N through poultry manure | 292.29 | 296.96 |
| T4: 75% RD of N +25% N through vermicompost | 328.71 | 333.35 |
| T5: 75% RD of N + 25% N through enriched compost | 298.78 | 304.02 |
| T6: 50% RD of N + 25% N through FYM +25% N through vermicompost | 364.44 | 372.18 |
| T7: 50% RD of N + 25% N through poultry manure + 25% N through enriched compost | 344.93 | 348.93 |
| T8: 50% RD of N + 25% N through FYM + 25% N through poultry manure | 336.27 | 350.55 |
| T9: 50% RD of N + 50% N through FYM | 281.29 | 288.14 |
| T10: 50% RD of N + 50% N through poultry manure | 313.82 | 317.31 |
| T11: 50% RD of N + 25% N through poultry manure | 301.32 | 304.39 |
| T12: 50% RD of N + 50% N through vermicompost | 306.38 | 309.98 |
| T13: 50% RD of N + 25% N through FYM | 301.28 | 306.62 |
| T14: 50% RD of N + 25% N through poultry manure |  293.96 | 300.44 |
| T15: 50% RD of N + 25% N through vermicompost | 306.04 | 314.15 |
| T16: 50% RD of N + 25% N through enriched compost | 279.50 | 287.35 |
| S.Em(±) | 9.21 | 7.87 |
| CD(P=0.05) | 26.60 | 20.74 |

INM-Integrated nutrient management

* 1. **Conclusion**

Based on results of two years experimentation, the integrated use of inorganic and organic sources of nutrients proved superior to inorganic alone in respect of growth parameters and yield of potato and babycorn in sequence.

 Among the different integrated nutrient management practices, application of 50% RD of N + 25% N through FYM + 25% N through vermicompost (T6) was found to be the best integrated nutrient management practice for overall growth and yield of potato and babycorn crop grown in sequence. It also resulted in better soil health parameters, net returns, benefit cost ratio as a whole.

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Author(s) hereby declare that generative AI technologies such as Large Language Models, etc. have been used during the writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology

Details of the AI usage are given below:

1. ChatGPT 3.5

* 1. **References**
1. AICRP (Potato) Annual Report (2018-19). All India Coordinated Research Project on Potato, ICAR, Shimla, India.
2. Dass, A.; Lenka, N.K.; Sudhishri, S. and Patnaik, U.S. (2004). Influence of integrated nutrient management on production, economics and soil properties in baby corn under on-farm condition in eastern ghats of Orissa. Indian J. Agril. Sci. 78: 40-43.
3. De, R. (1960). The role of nitrogen, phosphorus, and potassium in potato growth and tuber development. *Journal of Agricultural Science*, 55(3), 245-258.
4. FAO (2020). The State of Food and Agriculture. Food and Agriculture Organization of the United Nations, Rome.
5. Government of India (2019). Horticultural Statistics at a Glance. Ministry of Agriculture and Farmers Welfare, Department of Agriculture, Cooperation & Farmers Welfare, New Delhi.
6. Grewal, J.S., Kang, G.S., & Sharma, R.C. (1991). Effect of integrated nutrient management on potato production in alluvial soils. *Indian Journal of Agronomy*, 36(2), 220-225.
7. Grewal, J.S.; Saini, S.S. and Govindakrishnan, P.M. (1991). Potato based cropping systems. Technical Bulletin No. 30, pp. 1-20. Grewal, J.S. (ed). CPRI, ICAR, Shimla.
8. Islam, M.M., Karim, A.J.M.S., Jahiruddin, M., Majid, N.M., Miah, M.G., & Hakim, M.A. (2013). Effects of organic manure and chemical fertilizers on soil properties and the growth of potato. *Scientia Horticulturae*, 164, 157-167.
9. Khalak, A., & Kumaraswamy, K. (1992). Influence of integrated nutrient management on phosphorus and potassium uptake in crops. *Indian Journal of Soil Science*, 40(1), 30-34.
10. Lal, S.S. and Arora, P.N. (1994). Effect of phosphorous and potassium on bulking behaviour of potato cultivars at different growth stages. *J. Indian Potato Assoc.* **21**(1-2): 160-162.
11. Lal, S.S., & Arora, R.K. (1994). Nutrient management for sustainable potato production in India. *Indian Journal of Agricultural Sciences*, 64(10), 707-712.
12. Sharma, R.C. and Sharma, H.C. (1990). Stimulating effect of N on the uptake of P and K compared with P and K fertilization. *J. Indian Potato Assoc.* **17**:
24-29.
13. Sharma, R.C., & Sharma, J.P. (1990). Effect of NPK fertilization on potato yield and tuber quality in north-western Himalayas. *Journal of Indian Potato Association*, 17(1), 15-19.
14. Singh, S.K., Singh, R.K., & Lal, S.S. (2005). Impact of integrated nutrient management on tuber yield and soil properties in potato-based cropping systems. *Indian Journal of Horticulture*, 62(4), 382-385.
15. Subhani, A.; Changyong, H.; Zhengmiao, Y.; Min, L. and El-ghamry, A. (2001). Impact of soil environment and agronomic practices on microbial/ dehydrogenase enzyme activity in soil. Pakistan J. Biol. Sci. 4: 333-338.
16. Kumar, B., Barik, A. K., Saha, B., Patel, N., & Fatima, A. (2024). Influence of crop diversification in potato-based cropping sequence on growth, productivity and economics of potato in red and lateritic soil of West Bengal. *Indian Journal of Ecology*, *51*(1), 197-200.
17. Navarre, D. A., Brown, C. R., & Sathuvalli, V. R. (2019). Potato vitamins, minerals and phytonutrients from a plant biology perspective. *American Journal of Potato Research*, *96*, 111-126.
18. Kumar, P., Kumar, A., Kumar, N., Ahamad, A., & Verma, M. K. (2017). Effect of integrated nutrient management on productivity and nutrients availability of potato. *International Journal of Current Microbiology and Applied Sciences*, *6*(3), 1429-1436.
19. Ghosh, D. C. (2014). Integrated nutrient management in potato for increasing nutrient-use efficiency and sustainable productivity. In *Nutrient use efficiency: From basics to advances* (pp. 343-355). New Delhi: Springer India.
20. Islam, M. M., Akhter, S., Majid, N. M., Ferdous, J., & Alam, M. S. (2013). Integrated nutrient management for potato ('Solanum tuberosum') in grey terrace soil (Aric Albaquipt). *Australian Journal of Crop Science*, *7*(9), 1235-1241.