



Research Paper

# System productivity, profitability and economic efficiency as influenced by various levels and sources of nutrients in sweet corn-potato cropping systems

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**ABSTRACT :** An experiment on effect of integrated nutrient management in sweet corn-potato cropping sequence was conducted during *Kharif* and *Rabi* seasons of 2014-15 and 2015-16 at Instructional Research Farm, Central Campus, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri. The experiment was laid out in a Randomized Block Design with three replications in sweet corn and split plot design in potato crop. The soil of the experimental field was clayey in texture with low in available nitrogen ( $241.35 \text{ kg ha}^{-1}$ ), medium in available phosphorus ( $22.85 \text{ kg ha}^{-1}$ ) and high in potassium ( $365.75 \text{ kg ha}^{-1}$ ), moderately alkaline in reaction (pH 8.2). The treatments consisted  $T_1$  - 100 % GRDF,  $T_2$  - 75 % RDN + 25 % N through FYM,  $T_3$  - 75 % RDN + 25 % N through VC,  $T_4$  - 100 % RDN + 25 % N through FYM,  $T_5$  - 100 % RDN + 25 % N through VC,  $T_6$  - 125 % RDN + 25 % N through FYM and  $T_7$  - 125 % RDN + 25 % N through VC for *Kharif* sweet corn as a main plot treatment, whereas for *Rabi* potato two sub plot treatment levels of GRDF viz.,  $F_1$  - 75 % GRDF and  $F_2$  - 100 % GRDF replicated in split plot design resulting in seven treatment combinations replicated thrice during *Kharif* season and fourteen treatment combinations during *Rabi* season in RBD-split plot design replicated thrice. The experiment was conducted on same site without changing the randomization of the treatments for successive years. The data in respect of important growth and yield attributes of *Kharif* sweet corn and *Rabi* potato were recorded. The sweet corn-potato cropping sequence was also assessed through monetary benefits, micro climate meteorological parameters, nutrient uptake and cumulative nutrient balance sheet of nitrogen, phosphorus and potassium. The most important findings emerged from the present investigation are summarized below. Among the INM treatments, the various fertilizer levels to preceding sweet corn crop significantly influenced  $T_7$  - 125 % RDN + 25 % N through VC was found superior in growth attributes of sweet corn viz., plant height, number of leaves plant<sup>-1</sup>, leaf area and dry matter plant<sup>-1</sup> at all crop growth stages of sweet corn during both the years of *Kharif* season. The treatment  $T_7$  - 125 % RDN + 25 % N through VC recorded significantly higher values of all yield contributing characters of sweet corn viz., length of cob with husk (28.55 and 29.80 cm), girth of cob with husk (22.36 and 22.97 cm), length of cob without husk (23.88 and 24.92 cm), girth of cob without husk (18.82 and 19.87 cm), weight of cob plant<sup>-1</sup> (308.65 and 320.26 g), weight of cob without husk (255.33 and 256.87 g) cob<sup>-1</sup>, weight of husk (53.32 and 63.39 g), weight of grains cob<sup>-1</sup> (203.41 and 204.82 g), number of grain lines cob<sup>-1</sup> (18.44 and 18.65), number of grain lines<sup>-1</sup> (38.65 and 39.23), number of grains cob<sup>-1</sup> (712.71 and 731.64) weight of shelled cob (51.92 and 52.05 g) during both the years of investigation. The maximum and significantly higher green cob yield (275.55 and 281.55 q ha<sup>-1</sup>)

<sup>1</sup>), green fodder yield (542.83 and 554.19 q ha<sup>-1</sup>), biological yield (818.38 and 835.74 q ha<sup>-1</sup>) and harvest index (33.67 and 33.69%) of sweet corn was observed in treatment T<sub>7</sub>-125 % RDN + 25 % N through VC during both the years of *Kharif* season experiment. The treatment T<sub>7</sub>-125 % RDN + 25 % N through VC recorded significantly higher absorbed photo synthetically active radiation (APAR), photosynthetic rate, stomatal conductance, CO<sub>2</sub> concentration and lower values for stomatal resistance and leaf temperature at all the growth stages during both the years. The maximum gross monetary returns (Rs. 343198, Rs. 367449 and 355324 ha<sup>-1</sup>) were obtained by treatment T<sub>7</sub>-125 % RDN + 25 % N through VC, but the maximum net monetary returns (Rs. 266790, Rs. 284944 and Rs. 275867 ha<sup>-1</sup>) and B:C ratio (4.67, 4.69 and 4.68) were obtained by treatment T<sub>6</sub>-125 % RDN + 25 % N through FYM during both years and pooled mean over years. The quality parameters viz., protein content (12.01 and 11.81%), starch content (52.86 and 52.97 %) reducing sugar (3.70 and 3.72 %) non- reducing sugar (8.64 and 8.81 %) and total sugar (12.79 and 12.99 %) were at starch content (52.86 and 52.97 %) registered by treatment T<sub>7</sub>-125 % RDN + 25 % N through VC during both the years of experimentation. The maximum total uptake of nitrogen (304.57 and 291.73 kg ha<sup>-1</sup>), phosphorus (32.27 and 33.49 kg ha<sup>-1</sup>) and potassium (114.98 and 126.56 kg ha<sup>-1</sup>) by sweet corn was recorded with application of T<sub>7</sub>-125 % RDN + 25 % N through VC during both the years. Among the INM treatments, the various levels to preceding sweet corn crop significantly influenced T<sub>1</sub>-100 % GRDF was found superior in growth attributes of potato viz., plant height, number of leaves plant<sup>-1</sup>, leaf area and dry matter plant<sup>-1</sup> at all crop growth stages of potato during both the years of experimentation. The various INM fertilizer levels to preceding sweet corn crop significantly influenced T<sub>1</sub>-100 % GRDF was found to be superior in yield attributes of potato viz., medium tubers, big tubers, total tubers, weight of tubers per plant. The various fertilizer levels to preceding sweet corn crop significantly influenced T<sub>1</sub>-100 % GRDF was found to be superior in tuber yield (280.21 and 286.96 q ha<sup>-1</sup>) and haulm yield (12.31 and 13.52 q ha<sup>-1</sup>) during both the years of *Rabi* season experimentation. The various fertilizer levels to preceding sweet corn crop significantly influenced T<sub>1</sub>-100 % GRDF was found superior in total gross monetary returns (Rs. 294786, 330562 and 312674 ha<sup>-1</sup>), total net monetary returns (Rs. 185639, 210831 and 198235 ha<sup>-1</sup>) and B:C ratio (2.70, 2.76 and 2.73) during first year, second year and pooled mean over years. The quality parameters viz., protein content (9.47 and 9.56 %) and starch content (70.79 and 70.88%) were at higher magnitude registered by treatment T<sub>1</sub>-100 % GRDF during both the years of experimentation. The maximum total uptake of nitrogen (127.02 and 128.90 kg ha<sup>-1</sup>), phosphorus (20.02 and 20.31 kg ha<sup>-1</sup>) and potassium (151.61 and 153.13 kg ha<sup>-1</sup>) by potato was recorded with application of T<sub>7</sub>-125 % RDN + 25 % N through VC during both the years. The economic evaluation of sweet corn -potato cropping sequence was assessed in terms of net monetary returns and B:C ratio over the period of two years. The application of T<sub>6</sub>-125 % RDN + 25 % N through FYM to preceding crop sweet corn during *Kharif* season followed by F<sub>1</sub>-75 % GRDF to potato during *Rabi* season obtained maximum net monetary returns (Rs. 447329, Rs. 490200 and Rs. 468765 ha<sup>-1</sup>) and B:C ratio (3.47, 3.49 and 3.48) during both the years and the pooled mean over the years. The productivity of cropping system in term of sweet corn-equivalent yield (system productivity) was significantly higher in treatment T<sub>1</sub>-100 % GRDF (309.71, 329.99 and 319.85 q ha<sup>-1</sup>), but the maximum total system productivity yield (576.29, 602.92 and 589.61 q ha<sup>-1</sup>) were obtained by treatment T<sub>6</sub>-125 % RDN + 25 % N through FYM during both the years and the pooled mean over the years in sweet corn-potato cropping sequence. The maximum production efficiency was obtained by treatment T<sub>1</sub>-100 % GRDF (172.06, 183.33 and 177.69 kg ha<sup>-1</sup> day<sup>-1</sup>). But, relative economic efficiency (2485, 2723 and 2604 Rs. ha<sup>-1</sup> day<sup>-1</sup>) was recorded in treatment T<sub>6</sub>-125 % RDN + 25 % N through FYM during both the years and the pooled mean over the years. The performance of sweet corn-potato cropping sequence was assessed in terms of residual fertility status at the end of two years crop sequence. The treatment T<sub>1</sub>-100 % GRDF to preceding crop sweet corn during *Kharif* season registered minimum net loss of nitrogen, phosphorus and maximum gain of potassium as well as improved physico-chemical and biological properties. Based on two years of experiment it could be concluded that, application of treatment T<sub>6</sub>-125 % RDN + 25 % N through FYM and common seed treatment with *Azotobacter* + PSB to preceding crop sweet corn during *Kharif* season followed by F<sub>1</sub>-75 % GRDF to potato during *Rabi* season to obtain net monetary returns, benefits-cost ratio and maximum resource use efficiency and indicators of energy use efficiency. Application of FYM for the previous crop to get

better yield of next crop in arid and semi-arid regions of Maharashtra.

**KEY WORDS :** Cropping system, Potato, Profitability, Soil properties, sweet corn, System productivity

***Paper History :***

**Received :** 22.05.2019;

**Revised :** 15.07.2019;

**Accepted :** 16.08.2019

**HOW TO CITE THIS PAPER :** Gunjal, B.S. (2019). System productivity, profitability and economic efficiency as influenced by various levels and sources of nutrients in sweet corn- potato cropping systems. *Internat. Res. J. Agric. Eco. & Stat.*, **10** (2) : 262-271, DOI : **10.15740/HAS/IRJAES/10.2/262-271**. Copyright@ 2019: Hind Agri-Horticultural Society.