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Effect of cropping system and nutrient management practices on potato based cropping systems under north eastern hill region of India

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Abstract
A field experiment was conducted during summer and autumn season of the year 2016-2017 and 2017-2018 at Central Potato Research Station, Shillong, Meghalaya to find out the best cropping system and nutrient management practices on potato under Meghalaya agro-ecological condition. There were four cropping system *viz*; Potato-cauliflower, Potato –french bean, Potato-cabbage, Potato-radish considered as a main plot and five nutrient management practices *viz*; Control (Without any fertilizer) to potato and subsequent crop, 100% RDF to potato and subsequent crop, 50% RDN-FYM + 50% RDF to potato and 75% RDF to subsequent crop, 25% RDN-FYM +50% RDF + Azospirillum + PSB to potato and 50% RDF to subsequent crop, 50% RDN-FYM + 25% RDF + Azospirillum + PSB to potato and 50% RDF to subsequent crop considered as a sub plot which replicated three times under split plot design. During the 1st year (2016-17) it was observed that among the cropping system potato-cabbage give highest potato equivalent yield (30.01 t/ha) followed by potato-radish cropping system which give 28.86 t/ha potato equivalent yield. Among the nutrient management practices 25% RDN-FYM + 50% RDF + Azospirillum + PSB to potato and 50% RDF to subsequent crop give highest potato equivalent yield (27.95 t/ha) followed by 50% RDN-FYM + 50% RDF to potato and 75% RDF to subsequent crop which give 27.59 t/ha potato equivalent yield over rest of the treatments. During the 2nd year (2017-18) it was observed that among the cropping system potato-cabbage give highest potato equivalent yield (28.69 t/ha) followed by potato-radish cropping system which give 27.65 t/ha potato equivalent yield. Among the nutrient management practices 25% RDN-FYM + 50% RDF + Azospirillum + PSB to potato and 50% RDF to subsequent crop give highest potato equivalent yield (28.14 t/ha) followed by 50% RDN-FYM + 50% RDF to potato and 75% RDF to subsequent crop which give 27.84 t/ha potato equivalent yield over rest of the treatments.

Keywords: Potato, cropping system, FYM, Azospirillum, PSB, potato equivalent yield

Introduction
Potato (*Solanum tuberosum* L.) belongs to family Solanaceae, is one of the most important food crop in India after wheat, rice and maize. Integrated nutrient management is one of the most important agricultural practice which positively affects the production and productivity of the cropping system and improve the soil health for sustainable crop production. Integrated application of chemical fertilizers and organic manure maintains optimum physical, chemical and biological properties of the soil under intensive cropping (Kunda *et al.* 2016) [3]. Integrated use of inorganic and organic sources of nutrients significantly improved the yield of potato (Sumati Narayan *et al.* 2013) [5]. Chemical fertilizer dose along with organic fertilizers specially FYM, *Azotobacter* and crop residues increase the productivity of rice-potato-okra cropping sequence and improved the nutrient utilization by all the crops and at last minimize the use of chemical fertilizers without any deteriorations of soil health (Benerjee *et al.* 2016) [1]. Cropping system are important factors to be considered for the sustainability of any production system (Joshi *et al.* 2013) [2]. Application of Biofertilizers along with organic and inorganic fertilizers has positive and significant influence on yield and its attributes (Sethy BK *et al*. 2019) [4]. Integrated resource management improved the crop yields, produces quality grain as well as improved the soil fertility level (Sharma *et al*. 2013) [6].

Materials and Methods

The field experiment was conducted during summer and autumn season of the year 2016-2017 and 2017-2018 at Central Potato Research Station, Shillong, Meghalaya to find out the best cropping system and nutrient management practices on potato under Meghalaya Agro-ecological condition. Geographically experimental field are located at 25°54' N, 91°84' E and 1770 m above the mean sea-level. There were four cropping system *viz*; Potato-cauliflower, Potato –french bean, Potato-cabbage, Potato-radish considered as a main plot and five nutrient management practices *viz*; Control (Without any fertilizer) to potato and subsequent crop, 100% RDF to potato and subsequent crop, 50% RDN-FYM + 50% RDF to potato and 75% RDF to subsequent crop, 25% RDN-FYM +50% RDF + Azospirillum + PSB to potato and 50% RDF to subsequent crop, 50% RDN-FYM + 25% RDF + Azospirillum + PSB to potato and 50% RDF to subsequent crop considered as a sub plot which replicated three times under split plot design. Kufri Jyoti was the potato variety used in this research programme. The potato equivalent yield was calculated based on the current market price of the produces *viz*; potato @ Rs. 20000/t, cauliflower @ Rs. 25000/t, french bean @ Rs. 25000/t, cabbage @ Rs. 20000/t and radish @ Rs. 15000/t respectively. The recommended dose of N, P, and K was taken as 140, 120 and 60 kg/ha for the crop. Nitrogen, phosphorus and potassium was applied in the form of urea, SSP and MOP respectively. Biofertilizers (Azospirillum + PSB) was applied through seed tuber inoculation at the time of sowing. In the summer season potato are grown and in the autumn season subsequent crop are grown as per the treatment. Weeding was done after 30 days after planting and one more weeding was done after 45 days of planting in both the season crops. Plant protection measures were used as per standard recommendations in this region for potato crop as well as for the subsequent crops to control diseases and insects at the right time. All the statistical analysis was done by using OPSTAT statistical software.

Results and Discussion

Effect of different treatments on potato equivalent yield of the cropping system

The results revealed that during the 1st year (2016-17) among the cropping system potato-cabbage give highest potato equivalent yield (30.01 t/ha) followed by potato-radish cropping system which give 28.86 t/ha potato equivalent yield. Among the nutrient management practices 25% RDN-FYM + 50% RDF + Azospirillum + PSB to potato and 50% RDF to subsequent crop give highest potato equivalent yield (27.95 t/ha) followed by 50% RDN-FYM + 50% RDF to potato and 75% RDF to subsequent crop which give 27.59 t/ha potato equivalent yield over rest of the treatments. During the 2nd year (2017-18) it was observed that among the cropping system potato-cabbage give highest potato equivalent yield (28.69 t/ha) followed by potato-radish cropping system which give 27.65 t/ha potato equivalent yield. Among the nutrient management practices 25% RDN-FYM + 50% RDF + Azospirillum + PSB to potato and 50% RDF to subsequent crop give highest potato equivalent yield (28.14 t/ha) followed by 50% RDN-FYM + 50% RDF to potato and 75% RDF to subsequent crop which give 27.84 t/ha potato equivalent yield over rest of the treatments. Joshi *et al.* (2013) [2] reported that the productivity of tuber was highest in dhaincha – rice – potato cropping patterns as compared to other cropping patterns receiving equal amount of fertilizers. Benerjee *et al.* (2016) [1] reported that Rice – Potato- Okra based cropping system is good with integrated nutrient management in alluvial soil of West Bengal.

Table 1: Effect of different treatments on potato equivalent yield of the cropping system (2016-17)

Treatment	Economic yield (t/ha)		Potato equivalent yield (t/ha)	
Cropping system	**Summer**	**Autumn**	**Autumn crop**	**Cropping system**
Potato-cauliflower	13.70	5.86	7.33	21.04
Potato –french bean	12.89	4.65	5.81	18.70
Potato-cabbage	12.89	17.11	17.11	30.01
Potato-radish	13.59	20.37	15.27	28.86
S.Em+	0.40	0.01	0.02	0.41
CD (P=0.05)	NS	0.06	0.08	1.42
Nutrient management practices				
Control (Without any fertilizer) to potato and subsequent crop	7.87	11.20	10.59	18.47
100% RDF to potato and subsequent crop	12.11	11.78	11.17	23.28
50% RDN-FYM + 50% RDF to potato and 75% RDF to subsequent crop	15.94	12.27	11.65	27.59
25% RDN-FYM + 50% RDF + Azospirillum + PSB to potato and 50% RDF to subsequent crop	16.51	12.06	11.43	27.95
50% RDN-FYM +25% RDF + Azospirillum + PSB to potato and 50% RDF to subsequent crop	13.91	12.68	12.07	25.98
S.Em+	0.34	0.03	0.03	0.33
CD (P=0.05)	0.98	0.11	0.10	0.95

Table 2: Effect of different treatments on potato equivalent yield of the cropping system (2017-18)

Treatment	Economic yield (t/ha)		Potato equivalent yield (t/ha)	
Cropping system	**Summer**	**Autumn**	**Autumn crop**	**Cropping system**
Potato-cauliflower	13.54	5.67	7.09	20.64
Potato –french bean	12.83	4.43	5.54	18.38
Potato-cabbage	12.73	15.96	15.96	28.69
Potato-radish	13.39	19.01	14.26	27.65
S.Em+	0.23	0.01	0.01	0.23
CD (P=0.05)	NS	0.05	0.06	0.80

Nutrient management practices				
Control (Without any fertilizer) to potato and subsequent crop	6.70	7.39	7.08	13.79
100% RDF to potato and subsequent crop	11.99	11.81	11.22	23.22
50% RDN-FYM + 50% RDF to potato and 75% RDF to subsequent crop	16.15	12.32	11.69	27.84
25% RDN-FYM + 50% RDF + Azospirillum + PSB to potato and 50% RDF to subsequent crop	16.65	12.12	11.48	28.14
50% RDN-FYM +25% RDF + Azospirillum + PSB to potato and 50% RDF to subsequent crop	14.12	12.70	12.09	26.21
S.Em+	0.26	0.03	0.03	0.25
CD (P=0.05)	0.75	0.09	0.10	0.74

Conclusion

This study indicated that in the both year among the cropping system potato-cabbage give highest potato equivalent yield and among the nutrient management practices 25% RDN-FYM + 50% RDF + Azospirillum + PSB to potato and 50% RDF to subsequent crop give highest potato equivalent yield.

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