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Site Specific Fertilizer Requirement of Sugarcane and Potato as Intercrop under Sugarcane Based Cropping System

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ABSTRACT

The field study was conducted to determine the optimum and economic doses of fertilizers for sugarcane and potato as intercrop at three different locations of Jamalpur (AEZ 8), Sara, Ishurdi (AEZ 11) and Joypurhat (AEZ 3) during cropping year 2011-12 and 2012-13. It revealed that sugarcane yield was increased when it was intercropped with potato for the application of additional doses of fertilizer, cultural management and its residual effects of applied fertilizer to the intercrop. Yield data on sugarcane and potato at AEZ 8, AEZ 11, and AEZ 3, it showed that the highest yield (of two years) of cane of 128.50, 124.00 and 127.00 tha^{-1} and potato of 12.18, 9.53, 15.82 tha^{-1}, respectively were obtained from the T_6 treatment. Consequently, from the economic analyses it indicated that the highest economic benefit was also found from T_6 treatment, where soil test based of 100% NPKSZn with 25% additional dose of NPK for sugarcane (AEZ 8- N_{226} P_{29} K_{216} S_{18} Zn_5, AEZ 11- N_{214} P_{56} K_{113} S_{27} $Zn_{3.5}$ and AEZ 3-N_{224} P_{27} K_{159} S_{20} $Zn_{3.5}$) and potato (AEZ 8-N_{92} P_8 K_{81} S_4 Zn_2, AEZ 11- N_{78} P_{21} K_{38} S_6 $Zn_{1.5}$ and AEZ 3-N_{102} $P_{7.5}$ K_{60} S_5 Zn_2) were applied. Considering the yield and soil fertility status it revealed that the T_6 treatment was the best combination for higher sugarcane and potato yield.

Key words: Site specific, intercrop, brix %, yield

INTRODUCTION

Advantage in crop yield from intercropping system is achieved compared to sole cane due to synergistic effects of companion crops on each other by making better use of agronomic management and residual advantage of applied fertilizer for intercrops. Sugarcane crop depletes a considerable amount of nutrients from the soil. As a consequence soils lose its inherent ability to supply nutrient for sustainable production. Yadav *et al.* (1987) reported that the organic matter content of sugarcane soil increased due to companion crops. The combined return of cane and potato was always higher when both the crops were planted together and received their recommended doses of fertilizer (Bokhtiar *et al.*, 2002). Intercropping in sugarcane with potato, garlic, onion and vegetable is a common practice in cane growing countries. Intercropping has been recognized as a potential system for augmenting the productivity over space and time in

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subsistence farming situations. It increases total yield, higher monetary return, greater resource utilization and fulfil the diversified need of the farmers. Sing *et al.* (1986) and Rathi *et al.* (1974) observed that all combination of mastard potato, onion, fodder and sugarbeet with sugarcane proved more profitable than growing autum planted cane only. Rahman *et al.* (1994) conducted an experiment with mustard, lentil, potato, onion, tomato, garlic, chickpea and coriander as intercrop with sugarcane and observed that economic performance of all intercrops shows much higher benefit than sugarcane sole cropping. Sugarcane is a long duration and widely spaced crop and up to 120 days the canopy does not cover the vacant space in between the rows, as such there is ample scope to grow short- duration intercrops. Due to complementary effect of different crops when grown together, making better use of resources ultimately helps in productivity of sugarcane. The production of intercrop in sugarcane in Bangladesh is localized depending on the soil, environment and market. However, information regarding proper fertilizer management with potato, onion and garlic with sugarcane in intercropping system is scanty. Hence, the study was undertaken to find out optimum and economic doses of fertilizers for sugarcane and potato as intercrop under sugarcane based farming system.

MATERIALS AND METHODS

The experiment was conducted in 2011-12 and 2012-13 cropping seasons in three locations viz. Jamalpur (AEZ 8), Sara, Ishurdi (AEZ 11) and Joypurhat (AEZ 3) with eight treatments viz.,T_1 = STB 100% NPKSZn, $T_2 = T_1$ + 25% N, $T_3 = T_1$ + 25% NP, $T_4 = T_1$ + 25% NK, $T_5 = T_1$ + 25% PK, $T_6 = T_1$ + 25% NPK, T_7 = 75% of T_1, T_8 = Control with three replications. The experiment was laid out following Randomized Complete Block Design (RCBD). The plot size was 8m x 6m. The sugarcane variety was Isd 39 and; Potato variety was Cardinal. From the experimental plot, soil samples collection, sample processing (drying, sieving, storing) and follow up chemical analysis were done for determining the fertilizer doses. Nine soil samples at 0-15 cm depths were collected from each experimental plot. The experiment was set up in the month of November planting of potato and three eyed bud of sugarcane. One-third of nitrogen and potassium and the entire quantity of phosphorus, sulphur and zinc were applied in trenches and thoroughly mixed with the soil prior to planting of sugarcane and potato. One-third potassium and nitrogen were applied as top dressing at tillering stage (130 days). The remaining quantity of potassium and nitrogen were top dressed at late-tillering stage (about 180 days). Intercrop potato was harvested in March and sugarcane in December. Millable cane, yield of cane and Brix % were recorded from sugarcane, and in respect of potato only the yield data ware taken.

RESULTS AND DISCUSSION

Yield and yield attributes

At Jamalpur site, location 1, from table 1, it was found that in 2011-12 cropping season, the highest sugarcane and potato yield of 131.0 tha^{-1} and 14.0 tha^{-1} respectively were obtained from T_6 treatment which received 25% more NPK than recommended dose. In 2012-13 cropping season, treatment T_6 having T_1+25% NPK also produced the hieghest yield of sugarcane (118 tha^{-1}) and potato (12.4 tha^{-1}). Result from the study indicated that raising of intercrops influenced the sugarcane yield. This result supported by Paul *et al.* (2008) where they reported that the potato intercropping increased the

sugarcane yield. Application of soil test based of 100% NPKSZn with 25% surplus NPK produded better yield for sugarcane and potato, it might be due to complementary effect of growing intercrops and residual effect of plant nutrients on sugarcane crop that ultimately enhanced more cane yield compared to sole cane.

In 2011-2012 cropping season, at Jamalpur site location 2 data on the highest millable cane (121 x 10^3 ha^{-1}), yield (135 tha^{-1}), Brix (19.9%) and patato yield (10.8 tha^{-1}) were found in T_6 treatment. In 2012-2013 cropping season recorded data was different only in respect of millable cane. The highest millable cane (117x 10^3 ha^{-1}) was found in T_3 treatment which was received soil test based of 100% NPKSZn with 25% surplus NP but the highest yield of sugarcane (130 tha^{-1}) and potato (12.4 tha^{-1}) was found in T_6 treatment which was received 25% more NPK than recommended dose. It is indicated that intercropping with sugarcane had no adverse effect on sugarcane yield. Moreover residual effect of added fertiltizer and cultural management for the intercrops resulted more sugarcane yield. Adhikari and Karki (2006) tested potato experiment for three years in Agricultural Research Station(ARS), Napal and observed that increasing rate of potassium (0-100 kg ha^{-1}) significantly increased tuber yield (24.75 t ha^{-1}) Table 2.

At Ishurdi site location Sara

Data on millable cane (97x10^3 ha^{-1}), sugarcane yield (111 tha^{-1}) and potato yield (9.3 tha^{-1}) was higher in T_6 treatment in 2011-12 but in respect of millalble cane potato yield there were no significant different among the treatment T_1, T_2, T_3, T_4, and T_5 treatments. It seemed that combination of soil test based of 100% NPKSZn different packages miantained soil fertility status for different growing season. In 2012-2013 cropping season, the highest millable cane (108 x10^3 ha^{-1}), cane yield (137 tha^{-1}) and potao yield (9.8 tha^{-1}) was found from T_6 treatment where soil test based of 100% NPKSZn with 25% surplus NPK was applied. Soomro *et al.*, (2014) observed that tillers $plant^{-1}$, stem girth, internodes $plant^{-1}$, millable canes, and dry matter were higher with the application of 25% more than recommended fertilizer at 281.25-140-210 NPK kg ha^{-1} Table 3.

At Joypurhat site

In 2011-2012 cropping season, data on millable cane (117x10^3 ha^{-1}), cane yield (115 tha^{-1}) and potato yield (17.0 tha^{-1}) was the higher in T_6 treatment. In 2012-2013 cropping season, T_6 treatment having soil test based of 100% NPKSZn with 25% surplus NPK was recorded height millable cane (98x10^3 ha^{-1}), cane yield (139 tha^{-1}) and potato yield (14.6 tha^{-1}). This result supported by Dashora (2012) and reported that increasing rate of NPK up to 200:60:40 kg/ha significantly increased cane yield Table 4.

Economics of fertilizer use

The economic analysis of different fertilizer packages was done considering the total cost and gross return of the treatments. The economic benefit was greatly varied at different sites. At Jamalpur site location 1, in sugarcane-potato intercroping system the BCR was found 6.24. At Jamalpur site location 2, the highest economic benefit of 7.76 was found in T_6 which was followed by T_5 of 7.21. At Ishurdi site location Sara, the highest economic benefit of 6.50 was obtained from T_6 treatment which was closely related to T_5 of 5.47. At Joypurhat site, the highest economic benefit of 7.42 was found in T_6 which was followed by T_5 of 6.88 (Table 5-8).

Therefore, from the economic analyses of four locations it was found that the highest MBCR/economic benefit was found from T_6 treatment, where soil test based of 100% NPKSZn with 25% additional dose of NPK for sugarcane (AEZ 8- N_{226} $P_{29}K_{216}S_{18}Zn_5$, AEZ 11- N_{214} $P_{56}K_{113}S_{27}Zn_{3.5}$ and AEZ 3-N_{224} $P_{27}K_{159}S_{20}Zn_{3.5}$) and potato (AEZ 8-$N_{92}P_8K_{81}S_4Zn_2$, AEZ 11- $N_{78}P_{21}K_{38}S_6Zn_{1.5}$ and AEZ 3-$N_{102}P_{7.5}K_{60}S_5Zn_2$) were applied. Similarly at AEZ 8, AEZ 11, and AEZ 3 the highest yield of cane of 128.40, 124.15 and 127.00 tha^{-1} and potato of 12.18, 9.53, 15.82 tha^{-1}, respectively were also obtained from the T_6 treatment. Considering the yield and soil fertility status it revealed that the T_6 treatment was the best combination for higher sugarcane and potato yield.

Soil fertility status

The initial and post harvest nutrient status of soil pH, organic carbon, total N, available P, K, S and Zn for all sites are presented in Table 9-12. There are considerable decrease in organic matter in soil of Jamalpur site location 1, Ishurdi site location Sara and Joypurhat site but organic matter content of Jamalpur site location 2 was more or less same. The changes of total N, available P, K, S and Zn were not conspicous due to single year practice of using different ertilizer doses in experimental plots under study.

Table 1. Performances of sugarcane with potato as intercrop in different nutrient management packages at Jamalpur (location 1, AEZ 8)

Treatment	2011-12				2012-13			
	Sugarcane			Potato	Sugarcane			Potato
	Millable cane ($\times 10^3$ ha^{-1})	Yield (tha^{-1})	Brix (%)	Yield (tha^{-1})	Millable cane ($\times 10^3$ ha^{-1})	Yield (tha^{-1})	Brix (%)	Yield (tha^{-1})
T_1= STB 100% NPKSZn	117a	123ab	17.0c	11.5abc	79bc	100bc	17.8abc	9.9 bc
T_2 = T_1 + 25% N	115a	121ab	17.2bc	11.2bc	67cd	94cd	18.6 a	9.9 bc
T_3 = T_1 + 25% NP	119a	123ab	16.7c	11.6abc	94ab	112a	16.9cd	10.8 b
T_4 = T_1 + 25% NK	119a	125a	18.2abc	12.1ab	93ab	109ab	18.5ab	10.4 b
T_5 = T_1 + 25% PK	119a	125a	17.0c	12.9ab	96a	98cd	17.4bcd	11.7 a
T_6 = T_1 + 25% NPK	114a	131a	19.7a	14.0a	93.3ab	118a	17.9abc	12.4 a
T_7 = 75% of T_1	113a	108b	18.9ab	9.7c	66.9cd	89de	16.6d	9.4 c
T_8 = Control	91b	64c	17.8bc	6.6d	56.6d	80e	17.3cd	6.1 d
LSD (0.05)	15.66	15.11	1.53	2.12	15.36	9.713	1.036	0.9049

T_1 = N 180P38 K170 S20 Zn5.6 (sugarcane) and N73 P11 K65 S4 Zn2 (potato) for 2011-12

T_1 = N190 P18 K180 S18 Zn5.6 (sugarcane) and N78 P5 K65 S6 Zn1 (potato) for 2012-13

Table 2. Performances of sugarcane with potato as intercrop in different nutrient management packages at Jamalpur site (location 2, AEZ 8)

Treatment	2011-12				2012-13			
	Sugarcane			Potato	Sugarcane			Potato
	Millable cane ($\times 10^3$ ha^{-1})	Yield (tha^{-1})	Brix (%)	Yield (tha^{-1})	Millable cane ($\times 10^3$ ha^{-1})	Yield (tha^{-1})	Brix (%)	Yield (tha^{-1})
T_1= STB 100% NPKSZn	116a	121b	17.8bcd	7.2c	108ab	103b	17.2bcd	9.9b
$T_2 = T_1$ + 25% N	112a	116b	17.6cd	9.5b	111a	112b	17.0cde	10.6b
$T_3 = T_1$ + 25% NP	110a	115b	17.3d	7.0c	117a	109b	17.9ab	10.4b
$T_4 = T_1$ + 25% NK	115a	121b	18.4bc	7.5c	108ab	114b	16.2e	11.0b
$T_5 = T_1$ + 25% PK	119a	125ab	18.3bc	9.0b	104ab	124a	18.0ab	11.0b
$T_6 = T_1$ + 25% NPK	121a	135a	19.9a	10.8a	108ab	130a	17.7bc	12.4a
T_7 = 75% of T_1	114a	102c	18.6b	7.0c	102ab	104b	18.7a	8.3c
T_8= Control	88b	62d	17.8bcd	5.2d	93b	60c	16.8de	6.0d
LSD (0.05)	9.912	10.14	0.76	1.00	14.19	9.98	0.812	0.979

T_1= N183 P18 K170 S20 Zn4.5 (sugarcane) and N75P5K65S4Zn1.8 (potato) for 2011-12
T_1= N171P18K174 S15Zn4.5 (sugarcane) and N70 P5 K65 S3 Zn2 (potato) for 2012-13

Table 3. Performances of sugarcane with potato as intercrop in different nutrient management packages at Ishurdi site (location Sara, AEZ 11)

Treatment	2011-12				2012-13			
	Sugarcane			Potato	Sugarcane			Potato
	Millable cane ($\times 10^3$ha^{-1})	Yield (tha^{-1})	Brix (%)	Yield (tha^{-1})	Millable cane ($\times 10^3$ha^{-1})	Yield (tha^{-1})	Brix (%)	Yield (tha^{-1})
T_1= STB 100% NPKSZn	91 a	99 ab	19.2	8.6 ab	95 b	110 b	18.2	8.6 c
$T_2 = T_1$ + 25% N	89 a	90 b	18.3	8.4 ab	95 b	114 b	18.1	8.7 c
$T_3 = T_1$ + 25% NP	91 a	88 b	18.7	7.8 abc	92 b	109 b	18.6	8.2 d
$T_4 = T_1$ + 25% NK	89 a	89 b	18.5	8.6 ab	98 b	108 b	17.9	8.6 c
$T_5 = T_1$ + 25% PK	92 a	97 ab	18.7	9.0 ab	98 b	115 b	18.4	9.2 b
$T_6 = T_1$ + 25% NPK	97 a	111 a	18.6	9.3 a	108 a	137 a	17.9	9.8 a
T_7 = 75% of T_1	77 b	82 b	19.0	7.2 bc	95 b	96 c	18.3	7.0 e
T_8= Control	73 b	64 c	18.9	6.2 c	53 c	55 d	18.5	5.7 f
LSD (0.05)	8.34	16.22	NS	1.81	8.63	11.63	NS	0.19

T_1= N183 P18 K170 S20 Zn4.5 (sugarcane) and N75P5K65S4Zn1.8 (potato) for 2011-12
T_1= N171P18K174 S15Zn4.5 (sugarcane) and N70 P5 K65 S3 Zn2 (potato) for 2012-13

Table 4. Performances of sugarcane with potato as intercrop in different nutrient management packages at Joypurhat site (AEZ 3)

Treatment	2011-12				2012-13			
	Sugarcane			Potato	Sugarcane			Potato
	Millable cane ($\times 10^3$ha^{-1})	Yield (tha^{-1})	Brix (%)	Yield (tha^{-1})	Millable cane ($\times 10^3$ha^{-1})	Yield (tha^{-1})	Brix (%)	Yield (tha^{-1})
T_1 = STB 100% PKSZn	115 a	105 bcd	18.3	15.6 a	87 b	112 c	17.5	13.4 ab
T_2 = T_1 + 25% N	93 b	97 d	19.2	14.5 a	91 ab	123 b	16.5	13.3 ab
T_3 = T_1 + 25% NP	93 b	100 cd	19.0	16.7 a	90 ab	122 b	16.6	13.4 ab
T_4 = T_1 + 25% NK	105 ab	109 abc	18.8	16.8 a	87 b	112 c	16.3	12.9 b
T_5 = T_1 + 25% PK	109 ab	110 ab	18.6	15.8 a	91 ab	127 b	16.6	13.1 b
T_6 = T_1 + 25% NPK	117 a	115 a	18.8	17.0 a	98 a	139 a	16.5	14.6 a
T_7 = 75% of T_1	105 ab	86 e	19.3	15.2 a	83 b	102 d	16.8	10.5 c
T_8 = Control	91 b	66 f	18.6	11.1 b	71 c	68 e	16.9	8.9 d
LSD (.05)	17.78	8.21	NS	2.51	8.06	9.17	NS	1.22

T_1= N171P25 K127 S16 Zn3.5 (sugarcane) and N85 P7 K48 S6 Zn1.7 (potato) for 2011-12
T_1= N188 P18 K127 S24 Zn3.5 (sugarcane) and N78 P5 K48 S4 Zn2 (potato) for 2012-13

Table 5. Economic analysis of different treatment of Jamalpur site (location 1, AEZ 8)

Treatment	Yield (tha^{-1})		Adjusted cane yield (tha^{-1})	Cost of fertilizer (Tk.ha^{-1})		Total cost of fertilizer (Tk.ha^{-1})	Gross Return (Tk.ha^{-1})	Additional profit (Tk.ha^{-1})	MBCR
	Cane	Potato		Cane	Potato				
T_1	111.49	10.7	160.87	18582.04	9777.18	28359.22	418262	153686	5.42
T_2	107.68	10.55	156.37	20600.14	11013.98	31614.12	406562	154986	4.49
T_3	117.88	11.18	169.48	21425.14	11343.98	32769.12	440648	176072	5.37
T_4	117.3	11.25	169.22	21905.14	11733.98	33639.12	439972	175396	5.21
T_5	112	12.29	168.72	20712.04	10827.18	31539.22	438672	174096	5.52
T_6	124.3	13.21	185.27	22730.14	12063.98	34794.12	481702	217126	6.24
T_7	98.95	9.55	143.03	13982.02	8036.6	22018.62	371878	107302	4.87
T_8	72.54	6.33	101.76	-	-	-	264576	-	-

T_1= STB 100% NPKSZn ; T_2 = T_1 + 25% N ; T_3 = T_1 + 25% NP ; T_4 = T_1 + 25% NK ; T_5 = T_1 + 25% PK ; T_6 = T_1 + 25% NPK ; T_7 = 75% of T_1 ; T_8 = Control. Urea : Tk. 20 kg^{-1}, TSP : Tk. 22 kg^{-1}, MoP : Tk.15 kg^{-1}, Gypsum : Tk.10 kg^{-1}, Zinc sulphate : Tk.150 kg^{-1}, Price of sugarcane : Tk.2600 t^{-1}, potato : 12000 t^{-1}.

Table 6. Economic analysis of different treatment of Jamalpur site (location 2, AEZ 8)

Treatment	Yield (tha^{-1})		Adjusted cane yield (tha^{-1})	Cost of fertilizer ($Tk.ha^{-1}$)		Total fertilizer cost ($Tk.ha^{-1}$)	Gross Return ($Tk.ha^{-1}$)	Additional profit ($Tk.ha^{-1}$)	MBCR
	Cane	Potato		Cane	Potato				
T_1	112.04	8.25	150.09	17674.53	9803.63	27478.15	390244	165392	6.02
T_2	113.94	10.06	160.34	19582.93	10976.63	30559.55	416891	192039	6.28
T_3	112.28	8.72	152.52	20132.93	11196.63	31329.55	396555	171703	5.48
T_4	117.05	9.26	159.76	20872.93	11766.63	32639.55	415377	190525	5.84
T_5	124.32	10	170.47	19511.53	10759.63	30271.15	443232	218380	7.21
T_6	132.5	11.6	186.02	21422.93	11931.63	33354.55	483640	258788	7.76
T_7	103.04	7.62	138.44	13395.11	7396.34	20791.45	359931	135079	6.50
T_8	60.52	5.63	86.48	-	-	-	224852	-	-

T_1= STB 100% NPKSZn ; $T_2 = T_1$ + 25% N ; $T_3 = T_1$ + 25% NP ; $T_4 = T_1$ + 25% NK ; $T_5 = T_1$ + 25% PK ; $T_6 = T_1$ + 25% NPK ; T_7 = 75% of T_1 ; T_8= Control

Table 7. Economic analysis of different treatment of Ishurdi site location Sara (AEZ 11)

Treatment	Yield (tha^{-1})		Adjusted cane yield (tha^{-1})	Cost of fertilizer ($Tk.ha^{-1}$)		Total variable cost ($Tk.ha^{-1}$)	Gross Return ($Tk.ha^{-1}$)	Additional profit ($Tk.ha^{-1}$)	MBCR
	Cane	Potato		Cane	Potato				
T_1	104.5	8.6	141.19	17892.39	9174.27	27066.66	367094	143494	5.3
T_2	101.9	8.54	141.32	19736.59	10220.07	29956.66	367432	143832	4.8
T_3	98.7	8	135.62	21001.59	10811.57	31813.16	352612	129012	4.06
T_4	98.4	8.63	138.23	20426.59	10551.07	30977.66	359398	135798	4.38
T_5	106.05	9.31	149.02	19847.39	10095.27	29942.66	387452	163852	5.47
T_6	124.15	9.53	168.13	21691.59	11136.57	32828.16	437138	213536	6.5
T_7	88.9	7.1	121.67	13630.17	6999.13	20629.3	316342	92742	4.5
T_8	59.11	5.96	86	-	-	-	223600	-	-

T_1= STB 100% NPKSZn ; $T_2 = T_1$ + 25% N ; $T_3 = T_1$ + 25% NP ; $T_4 = T_1$ + 25% NK ; $T_5 = T_1$ + 25% PK ; $T_6 = T_1$ + 25% NPK ; T_7 = 75% of T_1 ; T_8= Control

Table 8. Economic analysis of different treatment of Joypurhat site (AEZ 3)

Treatment	Yield (tha^{-1})		Adjusted cane yield (tha^{-1})	Cost of fertilizer ($Tk.ha^{-1}$)		Total variable cost ($Tkha^{-1}$)	Gross Return ($Tk.ha^{-1}$)	Additional profit ($Tk.ha^{-1}$)	MBCR
	Cane	Potato		Cane	Potato				
T_1	108.45	14.52	175.46	15800.82	9028.24	24829.06	456196	162006	6.52
T_2	110	13.93	174.39	17748.22	10313.84	28062.06	453414	159224	5.67
T_3	111.05	15.05	180.51	18366.72	10575.34	28942.06	469326	175136	6.05
T_4	110.5	14.85	179.04	18704.22	10853.84	29558.06	462904	168714	5.75
T_5	118.45	14.45	185.14	17375.32	9829.74	27205.06	481364	187174	6.88
T_6	127	15.82	200	19322.72	11115.34	30438.06	520000	225810	7.42
T_7	94	12.84	153.26	11874.24	6894.38	18768.62	398476	104286	5.56
T_8	67	10	113.15	-	-	-	294190	-	-

T_1= STB 100% NPKSZn ; $T_2 = T_1$ + 25% N ; $T_3 = T_1$ + 25% NP ; $T_4 = T_1$ + 25% NK ; $T_5 = T_1$ + 25% PK ; $T_6 = T_1$ + 25% NPK ; T_7 = 75% of T_1 ; T_8= Control

Table 9. Nutrient status of initial and post harvest soil at Jamalpur site (location 1, AEZ 8)

Treatment	pH	OC (%)	(N %)	P (mg kg^{-1})	K (meq%)	S (mg kg^{-1})	Zn (mg kg^{-1})
Initial soil	6.12	0.33	0.065	14	0.10	20	0.41
Post harvest soil							
T_1= STB 100% NPKSZn	6.20	0.35	0.070	15	0.12	19	0.40
$T_2 = T_1$ + 25% N	6.15	0.33	0.070	14	0.11	18	0.41
$T_3 = T_1$ + 25% NP	6.12	0.34	0.065	15	0.12	18	0.39
$T_4 = T_1$ + 25% NK	6.15	0.35	0.070	15	0.12	19	0.38
$T_5 = T_1$ + 25% PK	6.20	0.35	0.065	14	0.13	18	0.39
$T_6 = T_1$ + 25% NPK	6.20	0.34	0.070	16	0.13	21	0.40
T_7 = 75% of T_1	6.15	0.33	0.060	14	0.11	19	0.39
T_8 = Control	6.10	0.30	0.060	13	0.10	18	0.38

Table 10. Nutrient status of initial and post harvest soil at Jamalpur site (location 2, AEZ 8)

Treatment	pH	OC (%)	N (%)	P (mg kg^{-1})	K (meq%)	S (mg kg^{-1})	Zn (mg kg^{-1})
Initial soil	5.95	0.42	0.06	25	0.10	20	0.57
Post harvest soil							
T_1= STB 100% NPKSZn	6.00	0.40	0.06	22	0.11	18	0.60
$T_2 = T_1$ + 25% N	6.10	0.41	0.07	21	0.12	19	0.58
$T_3 = T_1$ + 25% NP	6.05	0.39	0.07	22	0.12	18	0.58
$T_4 = T_1$ + 25% NK	6.10	0.39	0.07	21	0.13	19	0.59
$T_5 = T_1$ + 25% PK	5.95	0.40	0.07	22	0.12	19	0.58
$T_6 = T_1$ + 25% NPK	6.10	0.41	0.07	23	0.12	20	0.58
T_7 = 75% of T_1	6.00	0.40	0.06	22	0.11	18	0.57
T_8= Control	5.98	0.38	0.05	21	0.09	18	0.55

Table 11. Nutrient status of initial and post harvest soil at Ishurdi site (location Sara, AEZ 11)

Treatment	pH	OC (%)	N (%)	P (mg kg^{-1})	K (meq%)	S (mg kg^{-1})	Zn (mg kg^{-1})
Initial soil	7.50	0.58	0.070	7.0	0.20	31	0.72
Post harvest soil							
T_1= STB 100% NPKSZn	7.55	0.55	0.065	8.0	0.19	25	0.70
$T_2 = T_1$ + 25% N	7.60	0.54	0.065	7.5	0.20	26	0.68
$T_3 = T_1$ + 25% NP	7.60	0.55	0.060	7.5	0.21	25	0.68
$T_4 = T_1$ + 25% NK	7.58	0.58	0.060	7.0	0.20	26	0.65
$T_5 = T_1$ + 25% PK	7.6	0.56	0.065	7.5	0.20	25	0.66
$T_6 = T_1$ + 25% NPK	7.65	0.57	0.070	8.0	0.21	26	0.68
T_7 = 75% of T_1	7.60	0.56	0.065	7.0	0.19	25	0.65
T_8= Control	7.50	0.55	0.055	6.5	0.18	24	0.65

Table 12. Nutrient status of initial and post harvest soil at Joypurhat site (AEZ 3)

Treatment	pH	OC (%)	N (%)	P (mg kg^{-1})	K (meq%)	S (mg kg^{-1})	Zn (mg kg^{-1})
Initial soil	6.20	0.42	0.080	20.0	0.17	22	0.74
Post harvest soil							
T_1 = STB 100% NPKSZn	6.25	0.40	0.070	19.0	0.16	20	0.65
$T_2 = T_1$ + 25% N	6.22	0.41	0.070	19.0	0.16	19	0.6
$T_3 = T_1$ + 25% NP	6.20	0.40	0.065	19.5	0.15	20	0.65
$T_4 = T_1$ + 25% NK	6.18	0.41	0.070	19.0	0.17	20	0.67
$T_5 = T_1$ + 25% PK	6.20	0.41	0.070	19.5	0.18	19	0.68
$T_6 = T_1$ + 25% NPK	6.25	0.42	0.075	19.5	0.18	20	0.70
T_7 = 75% of T_1	6.18	0.40	0.060	19.0	0.16	19	0.68
T_8 = Control	6.15	0.40	0.065	18.0	0.15	17	0.65

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