Biological Forum – An International Journal 13(4): 616-626(2021)

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Effect of STCR based Nutrient Management on Quantity- Intensity Relationship of Potassium in Rice based Cropping Systems of Indo Gangetic Plains

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(Received 01 September 2021, Accepted 05 November, 2021)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: The present investigation examined different parameters of Quantity-Intensity (Q/I) relationship from study conducted during *kharif*, 2019 in Bihar Agricultural University, Sabour, Bhagalpur. The study was undertaken to check the effect of different approaches of fertilizer application under targeted yield based soil test crop response (STCR) method on Q/I relationship of potassium (K) under rice based cropping systems. Soil K fertility is often judged on the basis of K extraction by the method of neutral normal Ammonium acetate which has been unsuccessful in indicating cropping induced changes in soil. Therefore, Q/I relationship of K proves to be a better indication of K supplying power of soil. The hypothesis of present study was to know the actual K supplying power of the soil so that better estimation of K status could be made. For the present study, soil samples (0-15 cm) were collected from ongoing STCR experimental plots receiving nine different treatments which comprised of control, farmers' practice, general recommended dose, soil test based yield targets 30, 40 and 50 quintal/ha, replicated thrice in a randomized block design (RBD). Samples were taken before sowing and after harvesting of rice crop so that effect of cropping and fertilization on K status could be well known. The samples were then analysed for different Q/I parameters viz., potential buffering capacity (PBC^K), activity ratio of K (AR^K), labile K (K_L), loss or gain of K (ΔK) and specifically held K (K_x) by equilibrating the soil with 0.01M $CaCl_2$. The results showed that application of inorganic fertilizers in combination with vermicompost under IPNS approach increased AR^K value {0.0034 $(moles/L)^{0.5}$} which is an indicative of actual K-supplying capacity of soil. However, PBC^K value was highest in absolute control treatment, which indicated that PBC^K did not depict the actual fertility status of the soil. Therefore, it was obtained that chemical fertilizer in combination with organic sources (vermicompost) not only increased soil nutrients, but also increased supply capacity of soil K.

Keywords: Potassium, Quantity- Intensity (Q/I), soil test crop response (STCR), Integrated Plant Nutrient System (IPNS), randomized block design, potential buffering capacity.

INTRODUCTION

Potassium (K) is a major nutrient element required for plant that can be sometimes luxuriously absorbed by the plants. For applying optimum K fertilizer, crop requirement as well as available nutrient status of the soil needs to be considered (Tegegnework *et al*., 2015). In this regard, recommendations based on Soil Test Crop Response (STCR) concept are most precise as it involves combined use of soil and plant analysis, which provide information on real balance between applied and available nutrients in soil (Sharma *et al*., 2016). The rapidly available forms of K^+ are soil solution and exchangeable forms but these forms may not be a reliable indicator of actual K supplying capacity of soil under intensive cropping (Zhu *et al*., 2020). The availability of K to growing plants is dependent on the parameters like intensity, capacity and renewal rate of the soils. The K concentration present in the soil solution is the intensity of that soil, whereas, capacity is the total amount of K in soil that is available to replenish the soil solution fraction and this transfer is described by a kinetic factor i.e., renewal rate. Study of

Quantity-Intensity (Q/I) relationship is useful in understanding and evaluating the status of K^+ fertility of soils (Beckett, 1964). The Q/I relation of soil depicts the association between K availability or intensity factor (I) and the amount present in soil (Q), i.e., the changes of K adsorbed to the changes in soil solution concentration. Hence, the availability of K in the solution (intensity) and the inherent capacity of the soil to buffer the changes that occurs in this solution concentration are the important parameters which determine the effective availability of K to plants (Grimme, 1976; Raheb & Heidari, 2012). Q/I study helps in the prediction of the fate of added K source in soil profile and also the nature of K^+ source through sub-soil layer. Various studies have indicated that the uptake of K^+ by plants from the soil solution fraction depends on the concentration of calcium (Ca^{2+}) and magnesium (Mg^{2+}) ions (Evangelou *et al*., 1994). To assess this, the activity ratio, AR_e^K described by Beckett (1964) and its availability is one of the appropriate measures of the K dynamics because it quantifies the chemical potential of labile K that is present in the soil to that of chemical potential of labile (Ca+Mg).

The Q/I curve depicting the exchange of K with calcium and magnesium is drawn by plotting the exchangeable K change against the activity ratio of K which represents the permanent characteristic nature of a soil. This relationship is helpful in obtaining various other important parameters like labile K (K_L) which is a combination of non-specifically available K ($\Delta K°$) and specifically available K (K_x), equilibrium K concentration ratio and potential buffering capacity (PBC^K). These parameters when studied in correlation, described a better prediction of K^+ uptake by plants than the measurement of exchangeable K by 1N Ammonium acetate (NH_4OAc). In this perpective, the present study was conducted with the objective of evaluating the effect of STCR based nutrient management on parameters of Q/I of potassium under rice based cropping system, as rice is one of major staple food of Indo-Gangetic plain.

MATERIALS AND METHODS

The field experiment was started in the year 2017 at Bihar Agricultural College farm, Sabour, Bihar for “Developing and monitoring modified STCR equations for prominent crops in Agroclimatic Zone II, IIIA and III B of Bihar”. The present study was on the 3rd crop cycle (*Kharif* 2019) under rice-wheat and rice-maize cropping systems. The soils of the study fall in the order “Inceptisol” having illite minerals and sub group “Typic Ustifluvents” as per the taxonomic system of soil classification (Verma *et al*., 1976). The field experiment was conducted in Randomized Block Design (RBD) with 9 treatments and 3 replications with plot size of 24 m^2. The treatment details are as follows:

In rice, N, P and K was applied through urea, superphosphate and muriate of potash, respectively. In treatments comprising of STCR with IPNS approach, in addition to inorganic fertilizer, vermicompost was applied at the rate of 24 kg/plot. For rice crop, fertilizer application rate for farmers’ practice was 130:30:10 kg ha^{-1} of $N:P_2O_5:K_2O$ and recommended dose of fertilizers was 100:40:20 kg ha^{-1} of $N:P_2O_5:K_2O$. Plot-wise composite soil samples were collected before sowing and after harvesting of rice crop in Kharif 2019 from 0-15 cm depth and processed for further analysis. The method for determination of Quantity-Intensity relationship of potassium was given by Beckett (1964).

Table 1: Details of treatment.

	Treatments details
T_1	General fertilizer recommendation (100:40:20 kg ha^{-1})
T_2	Farmers’ practice (130:30:10 kg ha^{-1})
T_3	STCR with IPNS for low target yield (30 q ha^{-1})
T_4	STCR with IPNS for medium target yield (40 q ha^{-1})
T_5	STCR with IPNS for high target yield (50 q ha^{-1})
T_6	STCR without IPNS for low target yield (30 q ha^{-1})
T_7	STCR without IPNS for medium target yield (40 q ha^{-1})
T_8	STCR without IPNS for high target yield (50 q ha^{-1})
T_9	Absolute control

For analysis, soil samples were equilibrated with solution containing different concentration of potassium in 0.01M$CaCl_2$ L^{-1}. 5g soil of each sample was taken in 6 conical flasks and 50mL of 0, 2, 4, 6, 8, 10 and 20 mg kg^{-1} K solution (0.01M $CaCl_2$ and 100 mg kg^{-1}KCl) were added. The flasks were shaken for ½ hr on mechanical shaker and then filtered using filter paper. The filtrates were collected separately and K concentration estimated in flame photometer. Exchangeable Ca^{2+} and Mg^{2+} was also determined from those filtrates by EDTA titration of Versanate method. The funnels containing soil were washed with NH_4OAc (100 mL each). Collected leachates were then taken for the reading of K^+ concentration.

K concentration in initial and final (after equilibration) was expressed in meq L^{-1} and ΔK value was obtained by the difference between the K concentration in initial solution and final solution expressed in meq/100g or cmol (p^+) kg^{-1}. Q/I curve was prepared by plotting AR^K on the x-axis and their respective ΔK value on y-axis. K and Ca plus Mg concentration were expressed in moles/L and then activity ratio (AR^K) value was calculated by using the following formula

$$AR_K = \frac{a_K}{\sqrt{a_{(Ca+Mg)}}} = \frac{[K]}{\sqrt{[Ca]+[Mg]}} \times \frac{f_K}{\sqrt{f_{(Ca+Mg)}}}$$

Where, a_K = activity of K (moles L^{-1})

$a_{(Ca+Mg)}$= activity of Ca + Mg (moles L^{-1})

[K] = concentration of K (moles L^{-1})

[Ca+Mg] = concentration of Ca+Mg (moles L^{-1})

f_K= activity coefficient of K

$f_{(Ca+Mg)}$ = activity coefficient of Ca+Mg

Here, Ca^{2+} + Mg^{2+} was taken as single divalent ion as the activity coefficients of calcium and magnesium do not differ much at the dilution used in the experiment.

Activity coefficient calculated by Debye- Huckel equation given by

$$\log f_i = -AZ^2\sqrt{I}$$

Hence,

$$\log f_K = \frac{f_K}{\sqrt{f_{Ca+Mg}}} = \frac{0.509 \times I^{1/2}}{1 + I^{1/2}} - 0.086\, C_{Cl^-}$$

Where,

Z_i = valence of ion species 'i'

I = ionic strength, equal to ½ $\Sigma C_i Z_i^2$

C_i = concentration of ion species 'i' in moles L^{-1}

C_{Cl^-} = concentration of chloride ions in moles L^{-1}

For this experiment, soil was equilibrated with different strength of K^+ solution. ΔK was measured as the difference between the concentration of K^+ added in soil (initial) and K^+ in leachates. Generally, it is expressed in meq100g^{-1}.

Potential buffering capacity of soil potassium (PBC^K) is the measure ability of soil to maintain the intensity of K^+ in the soil solution and is calculated as follows.

$$PBC^K = \frac{K_L}{AR^K}$$

Where, K_L = Labile soil potassium

AR^K = Activity ratio of potassium

RESULT AND DISCUSSION

Data pertaining to effect of STCR based nutrient management before sowing and after harvesting of rice crop on various Q/I parameters i.e., PBC^K, AR^K, ΔK, K_L and K_X presented in Table 2-5 and, Q/I relationship of the same has been represented in Figs. 1-9 in which the intercept shows the AR^K and slope of the curve depicts the PBC^K value.

A. Effect of STCR based nutrient management on potential buffering capacity (PBC^K) in soil

In R-W cropping system, before sowing of rice (Table 2), PBC^K value found to be varying from 3.478 cmol (p^+) $kg^{-1}/(molL^{-1})^{0.5}$ in treatment comprising of STCR without IPNS for high target yield (T_8) and a maximum value of 9.667 cmol (p^+) $kg^{-1}/(molL^{-1})^{0.5}$ in absolute control (T_9). However, after harvest (Table 3), PBC^K value was found greater than initial value and found to be varying from 4.242 in T_8 to 9.904 cmol (p^+) $kg^{-1}/(molL^{-1})^{0.5}$ in T_9. In R-M cropping system, before sowing of rice (Table 4), PBC^K value varied from 4.009 to 9.887 cmol (p^+) $kg^{-1}/(molL^{-1})^{0.5}$ in treatment T_8 and T_9 respectively. On the other hand, after harvest (Table 5), PBC^K value varied from 4.348 cmol (p^+) $kg^{-1}/(molL^{-1})^{0.5}$ in T_8 to 9.943 cmol (p^+) $kg^{-1}/(molL^{-1})^{0.5}$ in T_9. It was observed that as the level of nutrients increased, there was a decrease in PBC^K values. The treatment comprising of farmers' practice and general fertilizer recommendation showed higher PBC^K than the STCR based targeted yield treatments in both the cropping system. This finding was supported by the results reported by Rupa *et al.* (2001), Roux and Summer (1968) who concluded that depletion of soil K increased PBC^K value in soil. Lower value of PBC^K in fertilized soil might be attributed to higher K saturation of these plots receiving inorganic or organic sources of nutrients as compared to unfertilized soil (Maclean, 1963; Munn and Mclean, 1975). In the present study, minimum value of PBC^K was observed in treatment comprising of STCR without IPNS for high target yield. These findings were in confirmation with the results obtained by Rupa *et al.* (2001). However, little change in its value was observed under different treatment combinations. Beegle and Baker (1987) reported that PBC^K measurement did not depicts the actual fertility status of the soil. Higher value of PBC^K under control treatment could be due to depletion of native K reserves as reported by Das *et al*. (2019). It may be also concluded that an increased PBC^K value will replenish the solution K content more efficiently after plant uptake, therefore is beneficial for plant growth.

B. Effect of STCR based nutrient management on Activity ratio (AR^K) of potassium in soil

Cropping of rice with and without IPNS treatments showed slight variability in AR^K value in the study. Under R-W cropping sequence, before sowing of rice (Table 2), AR^K value varied from 0.002 to 0.0031 (moles $L^{-1})^{0.5}$. The maximum value of AR^K was observed in treatment comprising of STCR with IPNS for high target yield. The value of AR^K in control was 55 per cent lower than the maximum value. Similarly, after harvest of rice (Table 3), AR^K varied from a lower value of 0.0022 (moles $L^{-1})^{0.5}$ in control (T_9) to a maximum value of 0.0034 (moles $L^{-1})^{0.5}$ under T_5. AR^K value in control was approximately 54 per cent lower than the maximum value i.e., in T_5. Under R-M cropping system, before harvest of rice (Table 4), AR^K value varied from a minimum value of 0.0019 (moles $L^{-1})^{0.5}$ in control to a maximum value of 0.0033 (moles $L^{-1})^{0.5}$ in treatment comprising of STCR with IPNS for high target yield. Similarly, after harvesting of rice (Table 5), these values varied from 0.0023 (moles $L^{-1})^{0.5}$ to 0.0034 (moles $L^{-1})^{0.5}$. In this case, the maximum value was observed in treatment comprising of STCR. High value of AR^K is generally related with K fertilization either with inorganic or organic source (Schlinder *et al*., 2005). The values of AR^K were in the range of 0.0020 to 0.0034 (moles $L^{-1})^{0.5}$. According to Schouwenburg and Schufelen (1963), if AR^K value remained <0.001, it depicted that the K was adsorbed at edge position, while if it is > 0.01(moles $L^{-1})^{0.5}$, then K was adsorbed at planar positions. Hence, from present study, it can be concluded that K got adsorbed on the planar sites of minerals. Similar were the range of values reported by Samadi (2006); Sharma *et al.*, (2012). Consequently, higher value of AR^K was observed under general fertilizer recommendation and farmers' practice in comparison to control in both the cropping system, either before sowing or after harvest of rice. This is because these treatments received marginal amount of K fertilization (Mukhopadhyay *et al*., 1992). Also, the treatments comprising of STCR with IPNS for low, medium and high target yield depicted higher value of AR^K than the similar treatments but without IPNS. These results showed that the partial substitution of inorganic fertilizer with organic manure favored release of soil K (Chen *et al*., 2020).

C. Effect of STCR based nutrient management on labile K (K_L) of potassium in soil

The values of K_L, ΔK, K_X were found to be having wide variability among different treatments. K_L was found minimum in treatment comprising of absolute control where no addition of fertilizers or manure was there. Under R-W cropping system, before sowing of rice (Table 2), the values of K_L varied from 0.287 to 0.361 cmol (p^+) kg^{-1}. The highest value in treatment STCR with IPNS for high target yield was significantly at par with the similar treatment without IPNS. After harvest of rice (Table 3), these values varied from 0.185 to 0.292 cmol (p^+) kg^{-1}. The maximum value was 57.8 per cent higher than the lowest value in control. Under R-M cropping system, before sowing of rice (Table 4), the values varied from 0.235 to 0.415 cmol (p^+) kg^{-1}. The values were higher in treatments with IPNS in comparison to respective treatments without IPNS. However, after harvest of rice (Table 5), values varied from 0.165 cmol (p^+) kg^{-1} in control to 0.267 cmol (p^+) kg^{-1} in treatment comprising of STCR with IPNS for high target yield. It was supported by Tuivavalagi *et al.* (1996) that addition of inorganic fertilizer with organic manure kept the concentration of exchangeable K at higher level which ultimately resulted in high level of K_L. Rupa *et al*. (2001) also reported that addition of K fertilizer resulted in increase in K_L value and soils with high K_L value showed higher AR^K value. The lower value of K_L in general recommended dose, farmers' practice and control in comparison to rest other STCR based treatments may be due to lack of balanced K fertilization which led to depletion in K over a period of time. Similar results were reported by Prasad *et al*., (2018). Sharma *et al*., (2012) from their study reported that higher value of labile K designated a greater amount of K release into soil solution pool.

Table 2 : Effect of STCR based nutrient management on different parameters of quantity- intensity under R-W cropping system before sowing of rice crop.

Treatments	PBCK [cmol(p+)kg-1/(mol L-1)0.5]	(-)ΔK [cmol (p+) kg-1]	ARK [(moles/L)0.5]	KL [cmol(p+) kg-1]	KX [cmol (p+) kg-1]
T1-General fertilizer recommendation	9.349	0.021	0.0025	0.307	0.063
T2-Farmers' practice	9.223	0.022	0.0024	0.298	0.067
T3-STCR with IPNS for low target yield	6.325	0.022	0.0026	0.325	0.074
T4-STCR with IPNS for medium target yield	5.998	0.023	0.0029	0.350	0.076
T5-STCR with IPNS for high target yield	5.332	0.025	0.0031	0.361	0.074
T6-STCR without IPNS for low target yield	6.704	0.020	0.0025	0.308	0.059
T7-STCR without IPNS for medium target yield	3.981	0.014	0.0027	0.343	0.071
T8-STCR without IPNS for high target yield	3.478	0.024	0.0030	0.361	0.064
T9- Control	9.667	0.012	0.0020	0.287	0.060

D. Effect of STCR based nutrient management on loss or gain of potassium (-ΔK) and specifically held potassium (K_X) of potassium in soil

ΔK value was obtained from the respective intercept of Q/I curves. Under R-W cropping system, values varied from 0.012 to 0.025 cmol (p^+) kg^{-1} in soils of before rice sowing (Table 2). After harvest, values were in the range of 0.011 to 0.027 cmol (p^+) kg^{-1} (Table 3). Similarly, under R-M cropping sequence, before rice sowing (Table 4), values of -ΔK were in the range of 0.015 to 0.031cmol (p^+) kg^{-1} and after harvest, it was in the range of 0.01 to 0.027 cmol (p^+) kg^{-1} (Table 5). ΔK represents that portion of graph that designates about the potassium that is adsorbed on non- specific site.

It was observed that greater negative value depicts greater release of soil K into soil solution which was observed in STCR based treatments for low, medium and high target yield. These results were in conformation with the findings reported by Lalitha and Dhakshinamoorthy, (2015). Generally, it was reported that greater negative balance of K under control, general recommended dose and farmers' practice caused more depletion of native K which led to lower value of -ΔK. Similar results were observed by Das *et al.*, (2019) and Zhang *et al.* (2011). Specifically held K depicts about those sites which have specific affinity for K. KX is designated as more important fraction than -ΔK in controlling the labile K pool. Zhang *et al.,* (2011); Islam *et al.*, (2017) also observed that KX shared greater portion in labile K pool. The results from the present study showed that continuous cultivation even in the case of more than recommended dose application (STCR with and without IPNS) resulted in more depletion of specifically held part of labile potassium. Similar were the results obtained by Das *et al.*, (2019).

Table 3: Effect of STCR based nutrient management on different parameters of quantity intensity under R-W cropping system after harvesting of rice crop.

Treatments	PBC^K [cmol(p^+) kg^{-1}/(mol $L^{-1})^{0.5}$]	(-)ΔK [cmol (p^+) kg^{-1}]	AR^K [(moles/L)$^{0.5}$]	K_L [cmol(p^+) kg^{-1}]	K_X [cmol(p^+) kg^{-1}]
T_1-General fertilizer recommendation	9.876	0.021	0.0027	0.207	0.053
T_2-Farmers' practice	9.649	0.021	0.0024	0.202	0.042
T_3-STCR with IPNS for low target yield	7.195	0.019	0.0028	0.254	0.040
T_4-STCR with IPNS for medium target yield	6.720	0.019	0.0030	0.277	0.050
T_5-STCR with IPNS for high target yield	5.885	0.027	0.0034	0.292	0.060
T_6-STCR without IPNS for low target yield	8.157	0.022	0.0028	0.247	0.055
T_7-STCR without IPNS for medium target yield	5.424	0.017	0.0029	0.262	0.053
T_8-STCR without IPNS for high target yield	4.242	0.025	0.0033	0.283	0.049
T_9- Control	9.904	0.011	0.0022	0.185	0.040

Table 4: Effect of STCR based nutrient management on different parameters of quantity- intensity under R-M cropping system before sowing of rice crop.

Treatments	PBC^K [cmol(p^+) kg^{-1}/(mol $L^{-1})^{0.5}$]	(-)ΔK [cmol (p^+) kg^{-1}]	AR^K [(moles/L)$^{0.5}$]	K_L [cmol(p^+) kg^{-1}]	K_X [cmol (p^+) kg^{-1}]
T_1-General fertilizer recommendation	9.783	0.023	0.0026	0.294	0.058
T_2-Farmers' practice	8.384	0.018	0.0020	0.264	0.078
T_3-STCR with IPNS for low target yield	7.898	0.026	0.0029	0.373	0.051
T_4-STCR with IPNS for medium target yield	5.811	0.025	0.0031	0.383	0.082
T_5-STCR with IPNS for high target yield	4.419	0.031	0.0033	0.415	0.078
T_6-STCR without IPNS for low target yield	6.078	0.019	0.0028	0.364	0.082
T_7-STCR without IPNS for medium target yield	4.401	0.024	0.0030	0.379	0.088
T_8-STCR without IPNS for high target yield	4.009	0.030	0.0032	0.394	0.074
T_9- Control	9.887	0.015	0.0019	0.235	0.062

Table 5: Effect of STCR based nutrient management on different parameters of quantity-intensity under R-M cropping system after harvesting of rice crop.

Treatments	PBC^K [cmol(p^+) kg^{-1}/(mol $L^{-1})^{0.5}$]	(-)ΔK [cmol (p^+) kg^{-1}]	AR^K [(moles/L)$^{0.5}$]	K_L [cmol(p^+) kg^{-1}]	K_X [cmol (p^+) kg^{-1}]
T_1-General fertilizer recommendation	9.878	0.019	0.0025	0.217	0.0464
T_2-Farmers' practice	8.39	0.017	0.0024	0.216	0.0503
T_3-STCR with IPNS for low target yield	8.326	0.025	0.0027	0.241	0.0549
T_4-STCR with IPNS for medium target yield	6.308	0.019	0.0030	0.254	0.0495
T_5-STCR with IPNS for high target yield	5.721	0.027	0.0034	0.267	0.0467
T_6-STCR without IPNS for low target yield	6.986	0.019	0.0026	0.228	0.0434
T_7-STCR without IPNS for medium target yield	4.693	0.019	0.0029	0.246	0.0417
T_8-STCR without IPNS for high target yield	4.348	0.025	0.0030	0.261	0.0504
T_9- Control	9.943	0.010	0.0023	0.165	0.0335

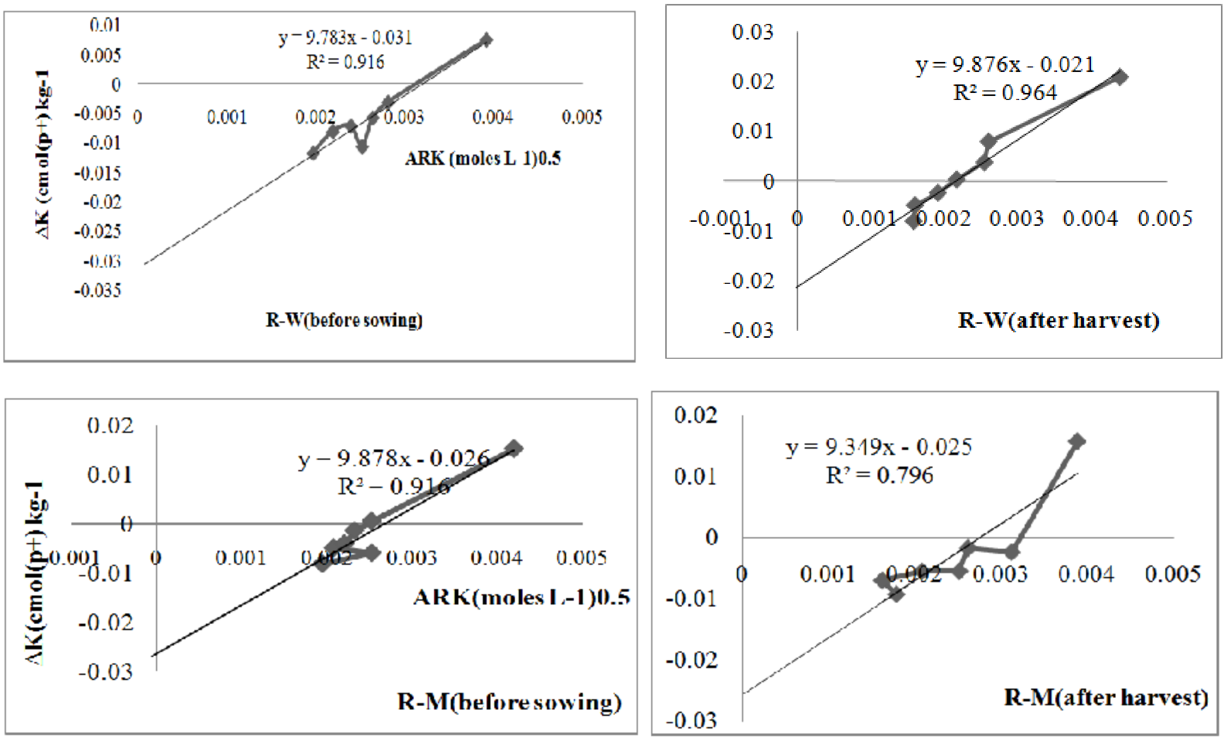

Fig. 1. Effect of treatment T_1: General fertilizer recommendation on quantity-intensity parameters of soil in R-W and R-M cropping sequence before sowing and after harvest of rice crop.

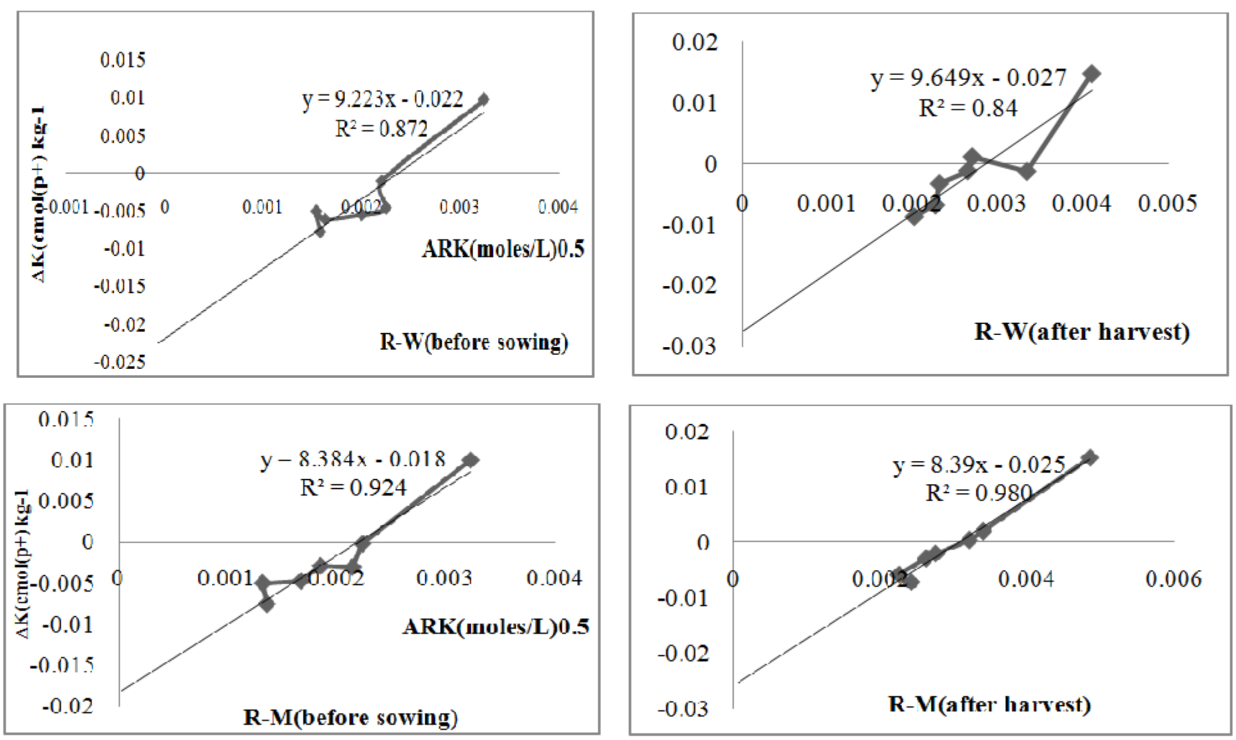

Fig. 2. Effect of treatment T_2: Farmers' practice on quantity-intensity parameters of soil in R-W and R-M cropping sequence before sowing and after harvest of rice crop.

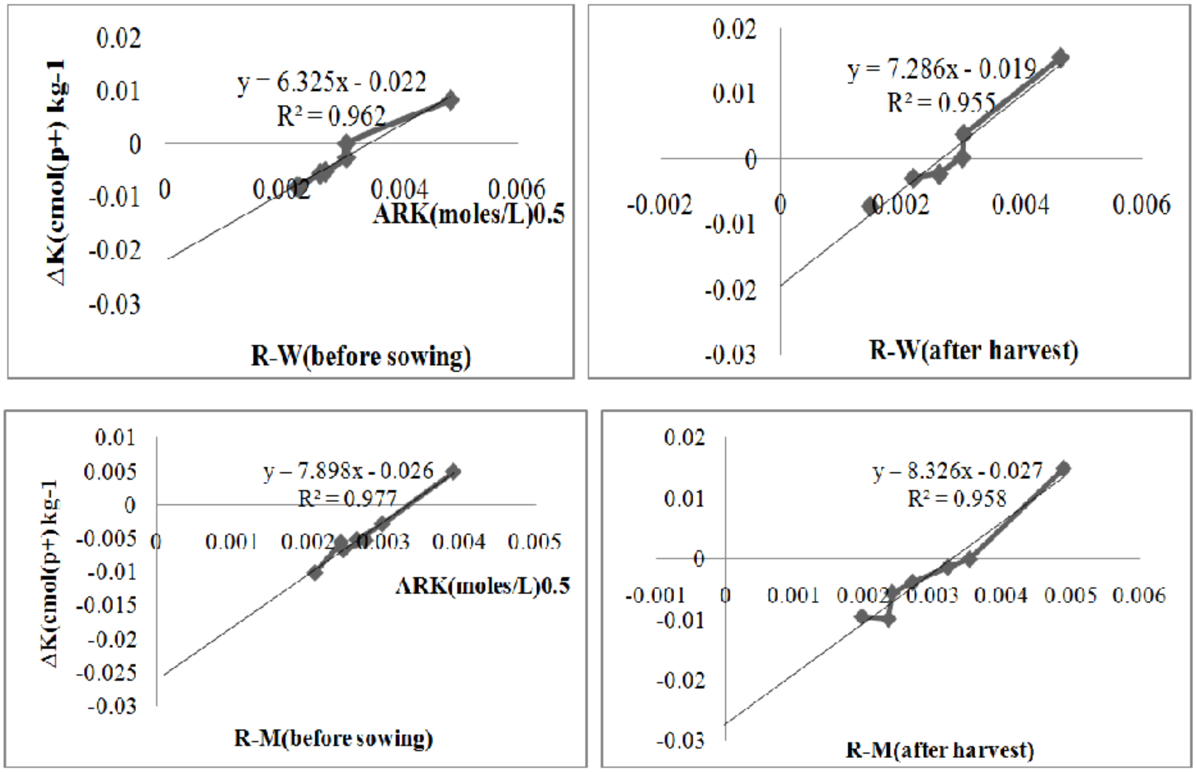

Fig. 3. Effect of treatment T_3: STCR with IPNS for low target yield on quantity-intensity parameters of soil in R-W and R-M cropping sequence before sowing and after harvest of rice crop.

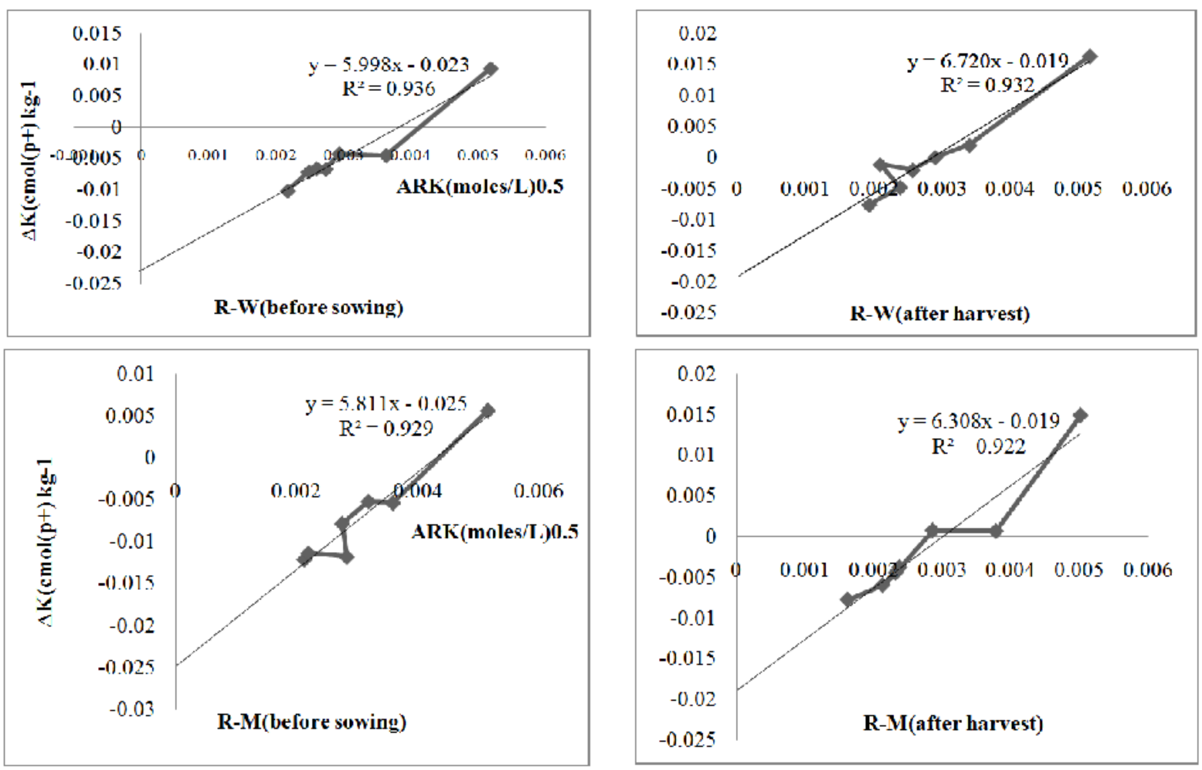

Fig. 4. Effect of treatment T_4: STCR with IPNS for medium target yield on quantity-intensity parameters of soil in R-W and R-M cropping sequence before sowing and after harvest of rice crop.

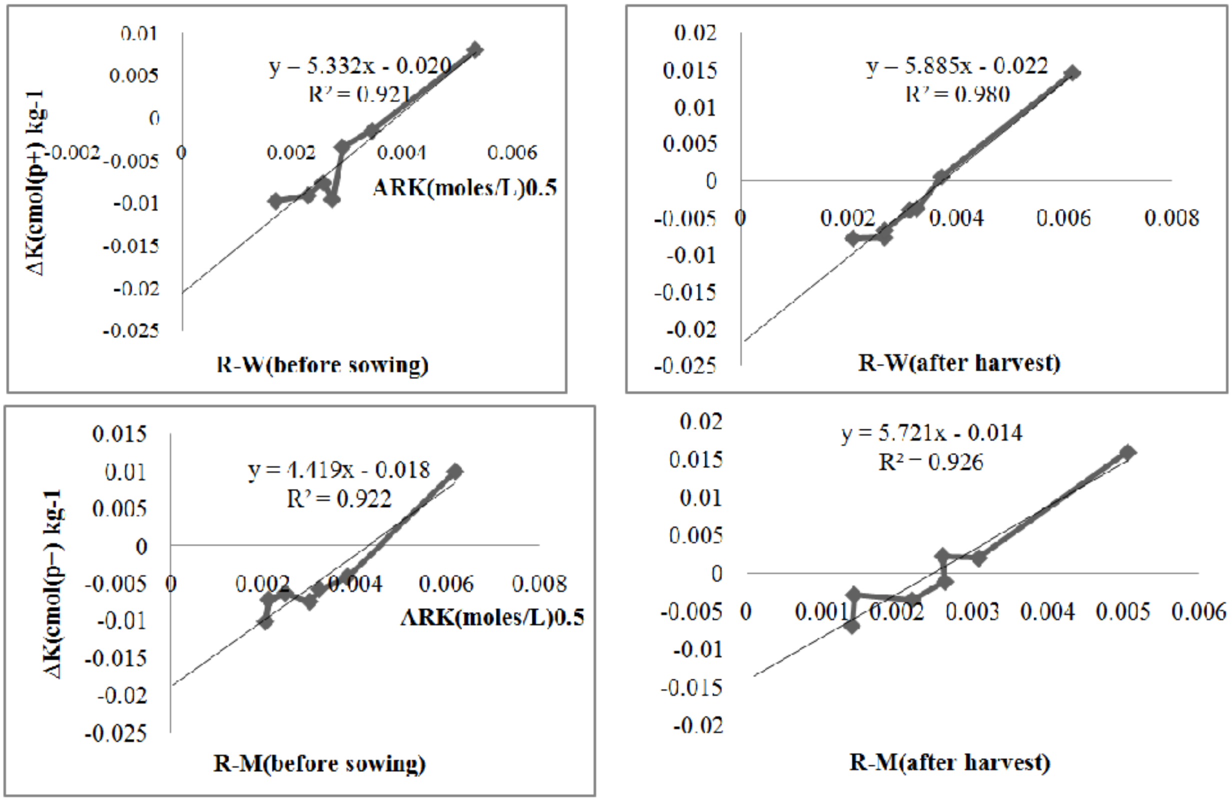

Fig. 5. Effect of treatment T_5: STCR with IPNS for high target yield on quantity-intensity parameters of soil in R-W and R-M cropping sequence before sowing and after harvest of rice crop.

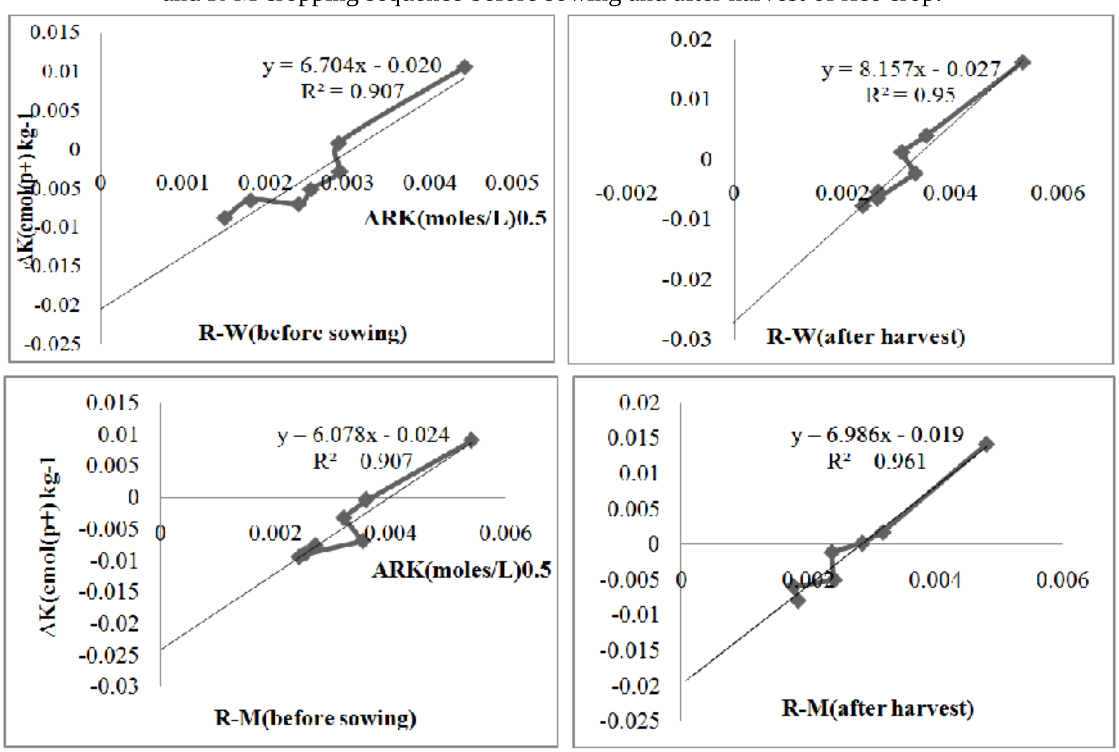

Fig. 6. Effect of treatment T_6: STCR without IPNS for low target yield on quantity-intensity parameters of soil in R-W and R-M cropping sequence before sowing and after harvest of rice crop.

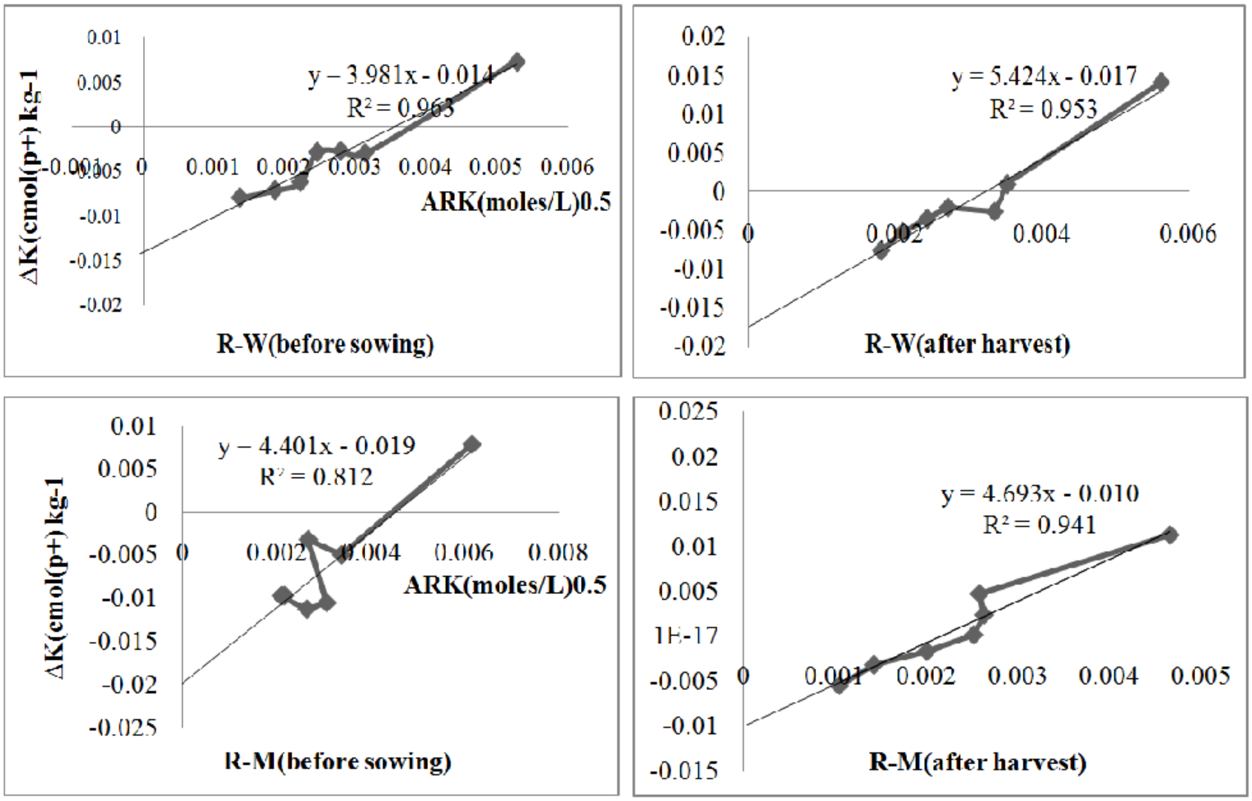

Fig. 7. Effect of treatment T_7: STCR without IPNS for medium target yield on quantity-intensity parameters of soil in R-W and R-M cropping sequence before sowing and after harvest of rice crop.

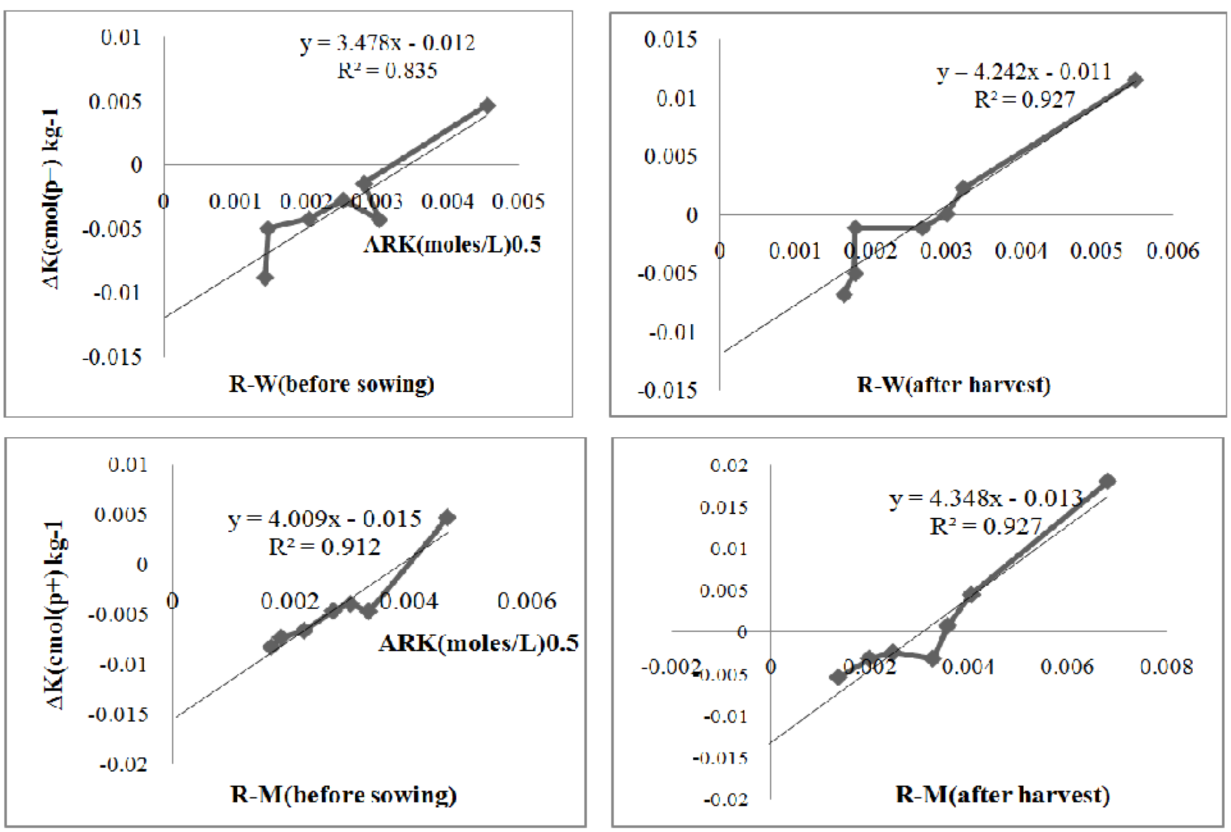

Fig. 8. Effect of treatment T_8: STCR without IPNS for high target yield on quantity-intensity parameters of soil in R-W and R-M cropping sequence before sowing and after harvest of rice crop.

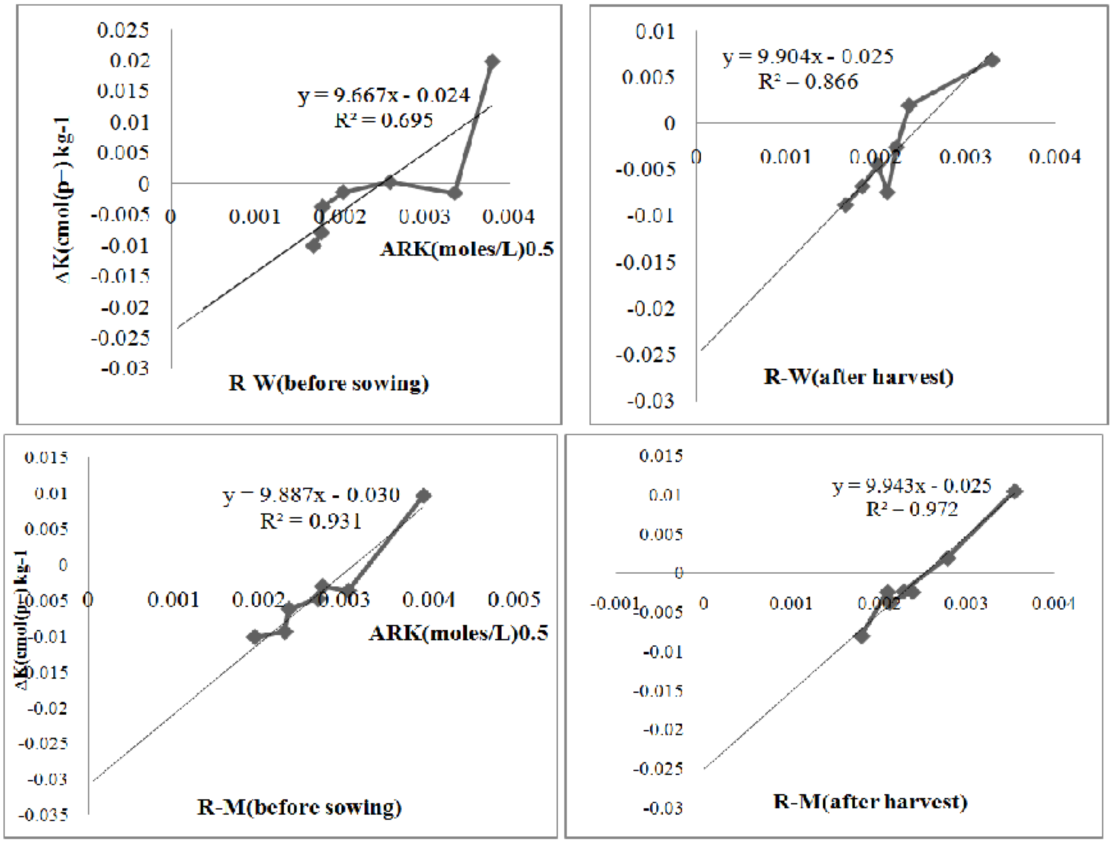

Fig. 9. Effect of treatment T_9: Absolute control on quantity-intensity parameters of soil in R-W and R-M cropping sequence before sowing and after harvest of rice crop.

CONCLUSION

The estimation of availability of K to crops & soil and the recommendation of K fertilizer are in general based on exchangeable K extraction by NH_4OAc method. But this is not recommendable for measuring actual K status of soil. The Q/I components such as labile K^+ (K_L), equilibrium activity ratio for K^+ (AR_e^K) and potential buffering capacity of K^+ (PBC^K) could serve as better indices of K^+ availability in the soils. These parameters study gave the better proposition of actual K supplying capacity of soil and based on that, further fertilizer recommendations can be made.

Acknowledgement. I am grateful to the Department of Soil Science and Agricultural Chemistry, Bihar Agricultural University, Sabour (India) for providing infrastructure for laboratory analysis.

Conflict of Interest. None.

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How to cite this article: Kumari, S.; Kumari, P.; Kumari, R.; Padbhushan, R.; Kohli, A.; Kumari, A.; Kumari, K. and Kumar, G. (2021). Effect of STCR based Nutrient Management on Quantity- Intensity Relationship of Potassium in Rice based Cropping Systems of Indo- Gangetic Plains. *Biological Forum – An International Journal*, *13*(4): 616-626.