

Research Article

On-farm evaluation of integrated nutrient management in potato (*Solanum tuberosum* L.) under south-western semi-arid zone of U.P.

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SUMMARY : On-farm trials were conducted at 3 locations of 3 villages in Firozabad district during *Rabi* season of 2006-07 and 2007-08 under farmer's own management to evaluate the best combination of chemical fertilizers with organic sources for sustainable productivity and economic viability of potato crop. The 100% NPK through chemical fertilizers and 50 and 75 % NPK through chemical fertilizers with vermicompost @ 5 t/ha, Nadep compost @ 20 t/ha and farm yard manure @ 20 t/ha were applied and tested. Application of 75% NPK through chemical fertilizers along with 5 t/ha vermicompost gave highest tuber yield of 336 q/ha with 41.17 per cent higher yield as compared to farmer's practice followed by 75% NPK through chemical fertilizers along with 20 t/ha nadep compost and FYM. Among different integrated nutrient management treatments of organic sources along with 75 % NPK through chemical fertilizers, vermicompost was found best compared to nadep compost and FYM in respect of higher tuber yield but net return and B:C ratio were high with Nadep compost followed by FYM. However, the maximum net return of Rs. 60,990/- and highest B:C ratio of 1:2.6 were recorded from application of 75% NPK through chemical fertilizers + 20 t/ha nadep compost. The minimum net return of Rs. 34,227/- and lowest B:C ratio of 1:1.7 were noted in farmer's practice. These results indicate that application of 75 % NPK through chemical fertilizers along with vermicompost @ 5 t/ha or nadep compost @ 20 t/ha or FYM @ 20 t/ha saved 25 % NPK and maintained the soil health for sustainable production.

KEY WORDS :

Farm yard manure, INM, Nadep compost, Potato, Vermicompost

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BACKGROUND AND OBJECTIVES

South western semi arid zone is the main potato growing tract of U.P. This zone alone shares 21 per cent area under potato in the state with 273.0q/ha average yield. This zone comprises the districts of Agra, Aligarh, Etah, Firozabad, Hathrus, Mathura and Mainpuri. Integrated nutrient management for maintaining soil fertility and supply of plant nutrient is a major source. For obtaining maximum nutrient-use-efficiency and crop yield there is need to be applied balance chemical fertilizers in conjunction with organic sources like F.Y.M., compost, green manure, crop residues, bio-

fertilizers etc. Such practice will also helpful in sustainable productivity without any soil deterioration.

Research evidences showed that potato crop responds well to organic manures application (Mondal *et al.*, 2005). In this zone the potato is grown under highly imbalance use of fertilizer management. The sources of plant nutrients supply is urea and DAP only. It is, therefore, imbalance supply of nutrients, the varieties of potato not performed well as per their potentiality in respect of productivity. Due to this miss management, soil fertility as well as physico-chemical properties of soil deteriorating day-by-day. Hence, the present study was undertaken in

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district Firozabad to develop strategies for utilizing all available organic sources and to evaluate the best combination of chemical fertilizers and organic sources for sustainable productivity and economic viability of potato crop as well as for maintenance of soil health. It will also be helpful to convince the farmers for adoption of the soil fertility management (SFM) practice.

RESOURCES AND METHODS

On-farm trials were conducted at same field for two consecutive years (2006-07 and 2007-08) during *Rabi* season at 3 locations in 3 villages of Firozabad district under farmer's own management. The soils of the pilot area were sandy loam to clay loam in texture having pH 7.60-8.20 and organic carbon 0.22-0.35 per cent. In case of available N, P₂O₅ and K₂O the soils were in low to medium. The N, P and K contents of vermicompost were ranging from 0.6-1.10, 0.2-0.3 and 0.3-0.5 per cent and of nadep compost 0.5-0.8, 0.5-0.6 and 1.0-1.2 per cent and of FYM 0.4-0.5, 0.2-0.3 and 0.3-0.5 per cent, respectively. The treatments consisted of T₁- farmer's practice, T₂- application of 100% NPK through chemical fertilizers, T₃- application of 75% NPK through chemical fertilizers along with 5 t/ha vermicompost, T₄- application of 75% NPK through chemical fertilizers along with 20 t/ha Nadep compost, T₅- application of 75% NPK through chemical fertilizers along with 20 t/ha FYM, T₆- application of 50% NPK through chemical fertilizers along with 5 t/ha vermicompost, T₇- application of 50% NPK through chemical fertilizers along with 20 t/ha Nadep compost and T₈- application of 50% NPK through chemical fertilizers along with 20 t/ha FYM. Each farmer field was considered as a one replication. Crop was planted in the third week of October in both years with a spacing of 60 x 20 cm. Chemical fertilizers and organic sources of nutrients were applied as per treatments. Entire P₂O₅ and K₂O and 50 % N were applied as basal dressing and rest 50 % N was top dressed at hoeing. Irrigation and plant protection measures

adopted as and when required. Most popular variety of the zone, *Kufri Bahar* (E-3797) was selected with 30-50 mm diameter size tubers, used @ 30-35 q/ha for planting. The seed was treated by 3 per cent solution of boric acid before planting. The crop was harvested 90-100 days after planting. The data were collected by interview in semi structured interview schedule and collected information was analyzed by using simple statistical techniques.

OBSERVATIONS AND ANALYSIS

The experimental findings obtained from the present study have been discussed in following heads:

Tuber yield:

The results revealed that all the treatments of integrated nutrient management were significantly superior as compared to farmer's practice in term of tuber yield (Table 1). Application of 75% NPK through chemical fertilizers along with 5 t/ha vermicompost (T₃) recorded the highest tuber yield of 336 q/ha, with 41.17 per cent high yield along with increase in tuber yield of 98 q/ha as compared to farmer's practice followed by application of 75% NPK through chemical fertilizers along with 20 t/ha nadep compost (T₄) and FYM (T₅). Application of 50% NPK through chemical fertilizers along with 5 t/ha vermicompost (T₆), 20 t/ha nadep compost (T₇) and 20 t/ha FYM (T₈) improved tuber yield with 21.42 per cent, 18.06 per cent and 10.92 per cent higher yield, respectively, over farmer's practice. Even T₃, T₄ and T₅ were also found superior in term of tuber yield with by 29 q/ha, 23 q/ha and 11 q/ha higher, respectively, as compared to application of 100% NPK through chemical fertilizers (T₂). It was due to that the addition of organic manure either in the form of vermicompost or nadep compost or FYM, they also increased the availability of nutrients through stimulatory effect of better efficiency of chemical fertilizers. These results corroborate the findings of Emin Caliskan *et al.* (2004). Organic manures

Table 1: Pooled data of tuber yield and economics of potato under different integrated nutrient management

Treatments	Tuber yield (q/ha)	Increase in yield over farmer's practice		Net return (Rs./ha)	B:C ratio
		Units	%		
T ₁ - Farmer's practice (F.P.)	238	-	-	34,227	1:1.7
T ₂ -100% NPK through chemical fertilizers	307	69	28.99	50,575	1:2.3
T ₃ - 75% NPK through chemical fertilizers + 5 t/ha vermicompost	336	98	41.17	52,480	1:2.4
T ₄ - 75% NPK through chemical fertilizers + 20 t/ha Nadep compost	330	92	38.65	60,990	1:2.6
T ₅ - 75% NPK through chemical fertilizers + 20 t/ha FYM	318	80	33.61	56,382	1:2.5
T ₆ - 50% NPK through chemical fertilizers + 5 t/ha vermicompost	289	51	21.42	44,550	1:2.0
T ₇ - 50% NPK through chemical fertilizers + 20 t/ha Nadep compost	281	43	18.06	49,886	1:2.2
T ₈ - 50% NPK through chemical fertilizers + 20 t/ha FYM	264	26	10.92	46,650	1:2.1

are not only the good source of major and micro nutrients but also improve the physico-chemical properties of soil (Reust and Neyround, 2003).

Economics:

The results revealed that the application of 75% NPK through chemical fertilizers along with 20 t/ha nadep compost (T_4) fetched maximum net return of Rs. 60,990/- per ha with the highest B:C ratio (1:2.6) followed by T_5 , T_3 and T_2 (Table 1). The application of increasing rate of NPK from 50 per cent to 75 per cent along with organic sources increased the net return and B:C ratio correspondingly. Application of 75 % NPK through chemical fertilizers along with vermicompost (T_3), nadep compost (T_4) and FYM (T_5) recorded the B:C ratio of 1:2.4, 1:2.6 and 1:2.5, respectively, which were slightly higher compared to application of 100% NPK through chemical fertilizers. Among different integrated nutrient management treatments of organic sources along with 75 % NPK through chemical fertilizers, T_4 and T_5 were found best over T_3 in respect of net return and B:C ratio, which may be due to high cost of vermicompost. The minimum net return (Rs. 34,227/-) with the lowest B:C ratio

(1:1.7) was recorded in farmer's practice due to lowest tuber yield.

Therefore, it may be concluded that the use of integrated nutrient management viz., 75 % NPK through chemical fertilizers along with vermicompost @ 5 t/ha or nadep compost @ 20 t/ha or FYM @ 20 t/ha may be preferred because it saved 25 % NPK and such practice will be helpful in maintaining sustainable yield and in future farmers of the pilot area will harvest the fruits of technology.

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