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Research Article

New Innovative Production Technology of Water Chestnut on Degraded Soil under Cropping System of Rabi and Summer Crops (SRA Model-6)

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Abstract

The study was undertaken in submerged water affected area from 2005-06 to 2019-20 in eight villages of Kanpur Nagar. The 30 farmers participated as partnership in this study. The main objective was to increase the farmers net income more than two fold. The secondary objective was to grow wheat under late sown condition in winter season and okra, sponge goard, bottle goard and pumpkin cultivation during spring/summer season under natural farming. The third objective was to utilize the submerged soil in double cropping system. Five cropping systems i.e., water chestnut – late sown wheat, water chestnut – okra (spring season), water chestnut – sponge goard (spring season), water chestnut – bottle goard (summer season) and water chestnut-pumpkin were tested. The *Kanpuri* cultivar of water chestnut was used in the study. The cultivars *Pusa-Supriya* sponge goard, *Azad Harit* of bottle goard, Pusa Vikas of pumpkin and *Azad Bindi-1* of okra were sown in spring to summer season. The 120.00 q/ha nuts of water chestnut was harvested, while wheat and fruits of okra harvested by 40 q/ha and 105 q/ha, respectively. The vegetable crops of sponge goard, bottle goard and pumpkin gave yield by 110.00 q/ha, 205.00 q/ha and 200 q/ha, respectively, during spring/summer seasons. The system productivity was computed by 132.30 q/ha under water chestnut – late sown wheat cropping system. The system productivity was computed by 225.00 q/ha in term of okra equivalent yield. The highest system productivity noted in term of equivalent yield of sponge goard, bottle goard and pumpkin by 230.00 q/ha, 325.00 q/ha and 320.00 q/ha, respectively. The net return and BCR were obtained by Rs. 10500.00/ha and 1:2.40, respectively, from water chestnut. Similarly late sown wheat gave net return and BCR by Rs. 38500.00/ha and 1:1.97, respectively. Vegetable crops okra, sponge goard, bottle goard and pumpkin gave net return Rs. 114568/ha, Rs. 132800/ha, Rs. 274800/ha and Rs. 267800/ha, respectively. The BCR calculated by 1:3.70 from okra, 1:5.12 from sponge goard, 1:9.40 from bottle goard and 1:9.31 from pumpkin cultivation. Therefore, inclusion of wheat and vegetables in the cropping system with water chestnut increased the farm families net income from 1.37 to 3.61 folds.

Keywords: *F.Y.M., Farm families, Green biomass, Natural farming, Net income, Water chestnut*

Introduction

A piece of degraded land suffer from submerged water is located in Central Plain Zone V of Uttar Pradesh under area jurisdiction of C.S. Azad University of Agriculture and Technology, Kanpur, which covered the villages *Sona, Chandra Hanspur, Khayampur, Mohanpur, Sajenri, Jugrajpur, Kalra and Chhatta purwa* of district Kanpur Nagar. This area suffers from imperfect drainage system. The waterlogging situation occurs during mansoon period from rain water. The tit-bit cultivation of water chestnut was

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adopted by some farmers. But due to poor knowledge of crop husbandry, the farming majority did not follow the crop cultivation in winter and spring/summer seasons. Therefore, the rotation intensity was found poor. The detail crops and soil survey was done and explored the possibility of double and intensive cropping system after nuts picking of water chestnut.

Since, the water chestnut has better survival crop in submerged condition because it is an aquatic herb floating in fresh submerged water. It has long flexuous stem, triangular leaves, white flowers and two spiny fruits, which is ascending on water. After picking of water chestnut (Singhara) fruits the rest green biomass left in the stagnated fields. The farmers advocated for drainage of water from their fields with the help of diesel driven pump sets. After some time these fields dry up and ready for ploughing. After receding and drainage of submerged water, the green biomass left by water chestnut ploughed and mixed in to the soil, which developed organic matter richness in the fields. The cultivation of late sown wheat has been suggested during winter season. The some field dry up late in winter season, which was used in vegetables cultivation during spring/summer season. The monoculture and monocropping system of water chestnut has been changed in double cropping systems and improved the families standard from poor to rich. Therefore, the main objective was to utilize the submerged fields for cultivation of winter, spring and summer seasons crop and generate the more income to the farm families. The secondary objective was to utilize the green biomass left by water chestnut in green manuring and raise the wheat and vegetable crops under natural farming and maintain the soil health.

Keeping the above point in view the quit flexible plan for changing of monocropping of water chestnut in water chestnut-late sown wheat and water chestnut-spring/ summer season vegetables system was planned. Therefore, for increasing the system productivity and more than two fold profitability is the subject matter of this manuscript.

Materials and Methods

The innovative on farm study was under taken on submerged affected area during 2005-06 to 2019-20 at village *Sona, Chandra Hanspur, Khayampur, Mohanpur, Sajenri, Jugrajpur, Kalra* and *Chhatta purwa* of district Kanpur Nagar. The 30 farmers participated as partnership in this study. The main objective was to increase the farmers net income more than two fold. The secondary objective was to grow wheat under late sown condition in winter season and okra, sponge goard, bottle goard and pumpkin cultivation during spring/summer season under natural farming. The third objective was to utilize the submerged soil in double cropping system. The soil samples were collected from the representative area and composite sample drawn for nutrients analysis. The experimental soil was sandy clay loam, having pH 7.8, organic carbon 0.38%, total nitrogen 0.03%, available phosphorus 10 kg/ha and available potassium 276 kg/ha, thus, the nutrients of experimental soil were analyzed low in organic carbon, total nitrogen, available phosphorus and high in available potassium. The pH was determined by Electrometric glass electrode method (Piper. 1950), while organic carbon was determined by Colorimetric method (Datta. *et al*., 1962). Total nitrogen was analyzed by Kjendahl's method as discussed by (Piper. 1950). The available phosphorus and potassium were determined by Olsen's method (Olsen. *et al*., 1954) and Flame photometric method (Singh. 1971), respectively. Five cropping systems i.e., water chestnut – late sown wheat, water chestnut – okra (spring season), water chestnut – sponge goard (spring season), water chestnut – bottle goard (summer season) and water chestnut – pumpkin (summer season) were tested. After onset of monsoon, the field submerged with rain, water chestnut cuttings of *Kanpuri* cultivar were planted. About 31250 cuttings of water chestnut were planted in one hectare area. The picking of nuts started from second week of October and nuts plucked every day

up to second fortnight of December in the study period. The recommended packages of practices for waterlogging area were followed in the cultivation of water chestnut. After last picking about 150-160 q/ha green biomass of water chestnut was turned into soil for green manuring. Due to tenderness it rotten very fast. After rotting of green biomass, field pulverized with application of farm yard manure. Chemical fertilizers were not used. In well prepared field, wheat sowing was done in first week of January in experimental years. Wheat variety K9423 was planted under late sown condition and harvested after 100 DAS. The cultivars *Pusa Supriya* of sponge goard, *Azad Harit* of bottle goard *Pusa Vikas* of Pumpkin and *Azad Bhindi-1* of okra were sown in spring to summer season. The recommended smart agronomical practices were followed in raising of wheat, okra, sponge goard, bottle goard and pumpkin crops. The irrigations were given as and when required. The good fruits size of vegetables was plucked as per market demand.

Results and Discussion

The data were recorded and reported in Table-1 and discussed here under appropriate heads:

Table-1: Yield of different crops and net profit as influenced by different cropping systems under submerged condition.
(*Pooled data of fifteen years*)

S. N.	Treatment	Yield (q/ha)		System productivity (q/ha)	System Profitability (Rs./ha)			BCR	Net Income increase in fold
		Water chestnut	Vegetables/Wheat		Cost of cultivation	Gross return	Net return		
1.	Water chestnut-wheat	120.00	40.00	132.30	114500	258000	143500	2.25	1.37
2.	Water chestnut-okra	120.00	105.00	225.00	117432	337000	219568	2.86	2.09
3.	Water chestnut-sponge goard	120.00	110.00	230.00	107200	345000	237800	3.21	2.26
4.	Water chestnut-bottle goard	120.00	205.00	325.00	107700	487500	379800	4.52	3.61
5.	Water chestnut-pumpkin	120.00	200.00	320.00	107200	480000	372800	4.47	3.55

Market sale rate of enterprises

1. Wheat – Rs. 1950 /quintal
2. Water chestnut – Rs. 1500 / quintal
3. Okra – Rs. 1500.00/ quintal
4. Sponge goard – Rs. 1500/quintal
5. Bottle goard – Rs. 1500/quintal
6. Pumpkin – Rs. 1500/quintal

System Productivity

Results displayed that the water chestnut produced the nuts by 120.00 q/ha. At initial years the productivity of nuts was found low

over the last years of observation. This was due to experience of farmers, which engaged as partnership in the study. These results are commensurable to the findings of (Singh. *et al.*, 2019), (Singh. *et al.*, 2019) and (Singh. *et al.*, 2020). The average grain yield of wheat was reaped by 40.00 q/ha under late sown condition. The fruits yield of okra harvested by 105 q/ha grown after picking of nuts of water chestnut. Similarly, sponge goard, bottle goard and pumpkin gave yield by 110.00 q/ha, 205.00 q/ha and 200 q/ha, respectively, during spring/summer seasons under cropping systems of water chestnut – sponge goard, water chestnut – bottle goard and water chestnut – pumpkin.

The system productivity was computed by 132.30 q/ha under water chestnut – late sown wheat cropping system. The system productivity was recorded by 225.00 q/ha in term of okra equivalent yield. Similarly, system productivity noted in term of equivalent yield of sponge goard, bottle goard and pumpkin by 230.00 q/ha, 325.00 q/ha and 320.00 q/ha, respectively.

System Profitability

The cost of cultivation for growing of water chestnut was calculated by Rs. 75000/ha. The gross return, net return and BCR were found by Rs. 180000/ha, Rs. 105000/ha and 1:2.40, respectively. Similarly, cost of cultivation for raising of late sown wheat was recorded Rs. 39500/ha. The gross return, net return and BCR was computed by Rs. 78000/ha, Rs. 38500/ha, and 1:1.97, respectively. Similarly, the okra cultivation displayed the cost of cultivation Rs. 42432/ha. The gross return Rs. 157000/ha, net return Rs. 114568/ha and BCR 1:3.70 were found in cultivation of okra after water chestnut. Likewise, cost of cultivation of Rs. 32200/ha was calculated under sponge goard crop, which was given gross return Rs. 1,65,000/ha, net return 1,32,800/ha and BCR 1:5.12. Amount Rs. 32700/ha and Rs. 32200/ha invested in the cultivation of bottle goard and pumpkin, respectively, which provided Rs. 307500/ha gross return Rs. 2,74,800/ha net return and 1:9.40 BCR from bottle goard and Rs. 3,00,000/ha gross return, Rs. 2,67,800/ha net return and 1:9.31 BCR from pumpkin. Therefore, net profit results clearly displayed that inclusion of wheat, okra, sponge goard, bottle goard and pumpkin in cropping systems of water chestnut-late sown wheat, water chestnut-okra, water chestnut-sponge goard, water chestnut-bottle goard and water chestnut–pumpkin increased the net income of farmers by 1.37, 2.09, 2.26, 3.61 and 3.55 fold, respectively.

Conclusion

The farm families residing in the waterlogged affected area and their holdings suffer from the waterlogged factor may be advocated for adoption of late sown wheat, okra, sponge goard, bottle goard and pumpkin after harvesting of water chestnut. It increase the farmers net income from 2 to >3 folds.

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