



Research Article

MANAGEMENT OF WATERLOGGED SOIL WITH CROPPING SYSTEMS OF WATER CHESTNUT AND RABI & SUMMER CROPS (SRA MODEL-3)

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Abstract: The study was under taken in waterlogged affected area from 2009-10 to 2014-15 at adjoining villages Gulkhara (Jivsiyani), Sahar, Auraiya district of Uttar Pradesh. The main objective was to increase the farm family's income more than two-fold. The secondary objective was to raise the wheat and onion crops under integrated nutrient management with conjunction of organic matter supplied by water chestnut green biomass. Before the initiation of study, the farmers of this locality were depending upon income. The possible crop of water chestnut was included before the harvesting of wheat or onion during rainy season for increasing the farmers income by 2 or >2 fold. The cropping systems i.e., water chestnut-wheat K-7903, water chestnut-wheat K 9423, water chestnut-wheat PBW- 373 and water chestnut-onion cv. Kalyanpur Red Round were tested. The Kanpuri cultivar of water chestnut was used in the study. The average nut yield of water chestnut was recorded 90.00 q/ha, while average wheat yield noted by 30.00 q/ha and onion by 215.00 q/ha after nuts plucking of water chestnut. The system productivity from water chestnut-wheat and water chestnut-onion was computed by 111.81 q/ha and 382.70 q/ha, respectively. The net return and BCR were obtained from water chestnut-wheat by Rs. 70000/ha and 1:1.61, respectively. Similarly, water chestnut-onion cropping system gave net return and BCR by Rs. 148575.00/ha and 1:1.93, respectively. Water chestnut inclusion in water chestnut-late sown wheat and water chestnut-onion cropping systems increased the farm family's income about 3-fold.

Keywords: Farm house hold, Green biomass, Mono cropping, Water chestnut, Water logged area

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Introduction

The water chestnut (*Trapa natans* Linn) called Singhara in Hindi is an aquatic herb floating in fresh water ponds. It has long flexuous stem, triangular leaves, white flowers and two spiny fruits, which is ascending on water. Therefore, water chestnut is a member of caltrop family trapaceae. Water chestnut, fruits contains citric acid, tannin, amylose, amylopectin, carbohydrate, beta-amylase, phosphorylase, protein, fat, nicotinic acid, riboflavin, thiamine, vitamins A & C and manganese. Its fruits are used as medicine in diarrhoea, dyscrasia, leucorrhoea, pregnant women given with milk in nervous and general debility & seminal weakness and stem juice in ophthalmic infections. Water chestnut also act as astringent nutritive, tonic, refrigerant, stomachic, anti-inflammatory and spermopoetic [1,2]. The experience gained from water chestnut ponds, situated in left and right bank of G.T. Road at Bhogaon, Mainpuri by the scientist, National Agriculture Research Project and Zonal Agricultural Research Station, Mainpuri. The dense cultivation of water chestnut is being done in these ponds. After picking of Singhara fruits the rest green biomass left in these ponds. After water receding from ponds partial green matter is decompose and rest dry up in situ. The decomposed green material developed organic matter richness in the ponds soil. The wasteland in Auraiya district of Uttar Pradesh is situated in Kannauj and Auraiya road. The farmers utilize this land only for growing of late sown wheat and onion under mono cropping system. Therefore, the farm families of this subjected area depend upon wheat and onion generated income. The main objective was to increase the farm family's income more than two-fold with adjustment of water chestnut in cropping system of water chestnut wheat and water chestnut onion. The secondary objective was to raise the wheat and onion crops under integrated nutrient management with organic matter supplied by water chestnut green

bomes. Keeping the above point in view the quite flexible plan for changing of fallow-wheat and fallow onion mono cropping systems in water chestnut-wheat and water chestnut-onion double cropping system was planned. Therefore, for increasing the system productivity and more than two fold profitability with water chestnut-late sown wheat and water chestnut-onion is subject matter of this manuscript.

Material and Methods

The innovative on farm study was under taken on 80 ha waterlogged affected area during 2008-09 to 2014-15 at adjoin villages of Gulkhara Auraiya (Uttar Pradesh). The main objective was to increase the farmers income more than two-fold. The secondary objective was to grow wheat and onion crops under organic farming after green manuring of water chestnut green biomass left after nut harvesting and improve the fertility status of soil. 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 8.0, organic carbon 0.35%, total nitrogen 0.03%, available phosphorus 10 kg/ha and available potassium 278 kg/ha, thus, the nutrients of experimental soil were analysed low in organic carbon, total nitrogen, available phosphorus and high in available potassium. The pH was determined by Electrometric glass electrode method [3], while organic carbon was determined by Colorimetric method [4]. Total nitrogen was analysed by Kjendahl's method as discussed by Piper (1950). The available phosphorus and potassium were determined by Olsen's method [5] and Flame photometric method [6], respectively. Four cropping systems i.e., water chestnut-wheat K-7903, water chestnut-wheat K-9423, water chestnut-wheat PBW-373 and water chestnut-onion were tested.

Table-1 Yield and income generated from water chestnut-late sown wheat and water chestnut-onion cropping systems (pooled data of six years)

SN	Treatment	Yield (q/ha)		System productivity (q/ha)	System profitability (Rs/ha)			Income increase in fold	
		Water chestnut	Wheat/ Onion		Cost of cultivation	Gross return	Net return	BCR	
1	Water chestnut – wheat PBW-373	90.00	31.30	113.11	114500	186645	72145	1.63	3.83
2	Water chestnut – wheat K-7903	90.00	28.70	110.51	114500	182355	67855	1.59	4.55
3	Water chestnut – wheat K-9423	90.00	30.00	111.81	114500	184500	70000	1.61	3.97
	Mean	90.00	30.00	111.81	114500	184500	70000	1.61	4.11
	Water chestnut-onion	90.00	215.00	382.70	159500	308075	148575	1.93	2.50

Before the onset of monsoon and early planting of water chestnut, the bunded fields filled with water and water chestnut cutting of Kanpuri cultivar were planted between mid-May to mid-June every year of study. About 31250 cuttings of water chestnut were planted in one-hectare area. The picking of fruits was started from second week of October and nuts plucked every day upto first week of December in the study period. The recommend package of practices for waterlogging area were followed in the cultivation of water chestnut. After last picking about 150 q/ha green biomass of water chestnut was turned up into soil for green manuring. Due to tenderness, it rotten very fast. After rotting of green biomass, field was pulverized through ploughing for sowing of wheat and transplanting of onion seedling. The wheat sowing was started from the last week of December and continued till first fortnight of January in every year. Similarly, onion seedling was transplanted in mid-January to end of January every year. Wheat varieties K-7903, K-9423 and PBW-373 were planted under late sown condition and these varieties harvested after 100 DAS. The Kalyanpur Red Round cultivar of onion was dug out after complete maturity of bulbs. The recommended integrated nutrient management practices were followed. The irrigations were given at short intervals to both *rabi* crops.

Results & Discussion

System productivity

Results displayed that the water chestnut produced the nuts by 90.00 q/ha. At initial years the productivity of nuts was found low over the last year of observation. This was due the experience of farmers, which engaged as partnership in the study. Similar observations have also been reported by Singh *et al.* (2017) [7], Singh *et al.* (2019) [1] and Singh *et al.* (2019) [2]. The average grain yield was reaped by 30.00 q/ha under late sown condition. The low grain yield of wheat in comparison to potential yield was due to late sowing of wheat under waterlogged area. Among the wheat cultivars, the highest average grain yield harvested from PBW-373 by 31.30 q/ha, while minimum average yield 28.70 q/ha produced by K-7903 under late sown condition. Cultivar K-9423 yielded average grain yield by 30.00 q/ha. Therefore, the average yield of wheat was weighed by 30.00 q/ha after water chestnut. The system productivity was computed by 111.81 q/ha under water chestnut-late sown wheat cropping system. The bulbs yield of onion was noted by 215.00 q/ha under water chestnut-onion cropping system. The system productivity was recorded by 382.70 q/ha in term of onion equivalent yield.

System profitability

The cost of cultivation for growing of water chestnut was calculated Rs. 75000/ha. The gross return, net return and BCR were obtained by Rs. 135000/ha, Rs. 60000/ha and 1:1.80, respectively. Similarly, cost of cultivation for raising of late sown wheat was recorded by Rs. 39500/ha. The gross return, net profit and BCR were computed by Rs. 58500/ha, Rs. 19000/ha and 1:1.48, respectively. Therefore, net profit results clearly displayed that inclusion of water chestnut in cropping system of water chestnut-late sown wheat increased the income of farm families more than 4 folds [Table-1]. The similar results also have been reported by Singh *et al.* (2019) and Singh *et al.* (2019). The cost of cultivation from growing of bulb of onion was computed by Rs. 84500/ha. The gross return, net return and BCR were calculated by Rs. 173075.00/ha, Rs. 88575.00/ha and 1:2.05, respectively. Thus, water chestnut-onion cropping system increased the farm family's income more than two-fold [Table-1]. These results are in agreement with those reported by Singh *et al.* (2017), Singh *et al.* (2019) and Singh *et al.* (2019).

Production of dry nut of water chestnut

Some farm families harvested their water chestnut produced in the form of dry nut.

About 80% nut yield was found in total produce. The 72.00 q/ha dry nut harvested and earned gross return Rs. 504000/ha.

Conclusion

The farmhouse holds residing in the waterlogged affected area and their holdings suffer from the waterlogged factor may be advocated for adoption of water chestnut – late sown wheat and water chestnut-onion cropping systems. It increase the farm income of farmers > 2.5 to 4 folds.

Application of research: Study of soil with cropping systems of water chestnut and *rabi* & *summer* crops

Research Category: Cropping systems

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Study area / Sample Collection:

Cultivar / Variety / Breed name: Water Chestnut

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

Ethical Committee Approval Number: Nil

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