Madras Agric. J., 87(7-9): 411 - 414 July - September 2000

https://doi.org/10.29321/MAJ.10.A00486

Water budgeting for components in lowland integrated farming systems

C. JAYANTHI, A. RANGASAMY AND C. CHINNUSAMY
Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore - 641 003, Tamil Nadu

Abstract : Field investigations were carried out to estimate water budgeting for the allied components like cropping, poultry, pigeon, fish and mushroom linked in lowland integrated farming systems at Tamil Nadu Agricultural University, Coimbatore during 1993-96. Water requirement for the allied components was estimated by adopting standard methodology. Results revealed that cultivation of rice-greengram-maize and rice-sunnhemp-maize cropping systems each in 0.50 hectare consumed 182 ha cm of water totally in a year. Whereas 201 ha cm of water was needed for rice-soybean-sunflower and rice-gingelly-maize cropping systems in 0.45 ha each involved in integrated farming systems. Poultry, pigeon, fish and mushroom components utilized 0.02, 0.04, 15.84 and 1.37 ha cm of water for their production in a year. Integration of cropping with pigeon + fish + mushroom utilized 218 ha cm as against 182 ha cm of water with conventional cropping system alone. Integration of poultry and pigeon required very little quantity of water and total water requirement in integration of improved cropping with fish + mushroom + poultry/pigeon was lesser than the water requirement of cropping alone in one hectare land area. Integrating efficient allied components with cropping results in effective water budgeting with better economic returns in lowland farming. *(**Key words** : Lowland, Integrated Farming system, Cropping system, Poultry, Pigeon, Fish, Mushroom, Water Budgeting.)*

Improved agricultural technologies, even though sound in scientific standards have limited value if they are not adopted due to their in appropriateness to suit the fluctuating agroclimatic and socioeconomic milleu persists among the farming community. Inadequacy of the traditional disciplinary oriented research strategies to solve the complex problems of small, resource poor farmers led to the evolution of more holistic and systematic approach known as farming systems research. Realising the need to tailor research to meet clients demand, many programmes have been initiated in the recent years with an orientation and focus on farming systems in the Indian Agricultural Research.

Recycling of resources and residues through integration could open wide scope for production expansion at larger area. The ultimatum of sustainable agriculture is to conserve the natural resource base and protect the environment by enhancing health and safety over a longer period. Integrated farming systems comprising of crop and livestock has been sustainable over centuries. The system could be able to meet food needs of the ever increasing population till recently. In this system, animals are raised on agricultural waste and the animal power is used for agricultural operation, end voids are used as manure and fuel. Tiwari (1993) reported that in the integrated farming the yield would be inherently more sustainable because the waste of one enterprise becomes the input of another leaving almost no waste to pollute the environment.

Rice + fish + azolla farming systems were developed for lowlying wetlands of Western Zone (Shanmugasundaram and Balusamy, 1993) and for Thanjavur deltaic region by Shanumugasundaram and Ravi (1992) for upgrading the farm production potential through integrated farming system. Similarly, rice + fish integration for small farm holding in Malawi in South Africa was recommended by Noble and Rashidi (1990) in the lowland agro-eco systems. Whereas, Thanh Hung (1992) suggested fresh water prawn and marine shrimp culture for integration to coastal rice farming in Vietnam. Therefore, an on station investigation was carried out to estimate, water budgeting for the allied components like cropping, poultry, pigeon, fish and mushroom linked in lowland integrated farming systems.

Materials and Methods

The components included in the integrated farming system were cropping, fishery, poultry, pigeon and mushroom production. The experiment integrating the said component was carried out with one year spell repeating two occasions during September, 1993 through August, 1994 and September, 1994 through August, 1995 at Tamil Nadu Agricultural University, Coimbatore. The components were selected bearing in mind their popularity and suitability to lowland situations of Tamil Nadu. Lowlands of Tamil Nadu possessing copious water supply at least for six to nine months have rice as dominant crop. This could very well provide opportunity for the linkage of fishery as component II in the programme. It has already been identified that droppings of poultry as a good source of feed for fish growth (Rangasamy and Jayanthi, 1994). Pigeon dropping with comparable composition as that of poultry dropping, not being tried earlier was also included to identify the feasibility of linkage in the lowland farming system. Rice straw being a major input for the cultivation of edible mushroom and by product in the rice based system, mushroom component was added to explore its potentiality in generating income and employment on holistic approach.

Farming system treatment

T1 Conventional cropping systems with crop alone 0.40 ha

T2 IFS with crop + fish (Artificial feeding) + mushroom 0.40 ha

T3 IFS with crop + fish + poultry + mushroom 0.40 ha

T4 IFS with crop + fish + pigeon + mushroom 0.40 ha

Conventional cropping systems

	Sep-Jan		Feb-Apr.		May-Aug	
i	Rice	-	Greengram	-	Maize	0.20 ha
ii	Rice	-	Sunnhemp	-	Maize	0.20 ha

Cropping systems in IFS

	Sep-Jan		Feb-Apr		May-Aug	
i	Rice	-	Soybean	-	Sunflower	0.18 ha
ii	Rice	-	Gingelly	-	Maize	0.18 ha

For fishery, fingerlings belonging to six species were stocked at 400 numbers per 0.04 ha area of pounded water. Water level in all the ponds was maintained at 50 cm height initially at the time of release of fingerlings and subsequently raised to 60, 70, 80 and 90 cm at an interval of 30 days. From fourth month onwards, water level in the pond was maintained to 90 cm till the harvest of grown up fish to compensate the evaporation and seepage loss through pumped water every week. For poultry, twenty numbers of eighteen weeks old Bapkok chicks were sheltered in a shed. For Pigeon, forty pairs of pigeon were sheltered near the second fishpond. Birds were allowed to go for open grazing in the fields in and around the system and not been supplemented with any other material. For mushroom, mushroom cultivation was carried out with a capacity of 2 kg day^{-1} allowing recycling of paddy straw from the component. Water requirement of the components was worked out and the productivity of components was converted in to rice grain equivalents on the basis economics.

Results and Discussion

Water requirement

Cultivation of rice-greengram-maize and rice-sunhemp-maize cropping alone consumed 182 ha cm of water, 201 ha cm of water was needed for rice-soybean-sunflower and rice-gingelly-maize cropping systems in 0.90 ha included in integrated farming systems (Table 1). Poultry, pigeon, fish and mushroom utilized, respectively, 0.02, 0.04, 15.84 and 1.37 ha cm of water for their production in an year. Integration of cropping with pigeon + fish + mushroom utilized 218.25 ha cm as against 182.00 ha cm of water with cropping alone. Integration of poultry and pigeon required very little quantity of water and total requirement of water in integration of cropping with fish + mushroom + poultry/pigeon was lesser than the total water requirement of cropping alone in a hectare area.

Productivity

The productivity of the respective components integrated in each system was finally converted as rice grain equivalent on the basis of prevailing unit cost of the produce of each component. Integration of cropping with components like fish and mushroom as well as poultry and pigeon resulted in higher productivity than cropping alone during both years. In 1993-94, highest productivity of 33,512 kg of rice grain equivalent yield was obtained by integrating pigeon + fish + mushroom and rice based cropping applied with composted pigeon manure to rice alone in the cropping system (Table 2). The crop sequences contemplated under crop activity in the integrated systems tried viz., rice-soybean-sunflower and rice-gingelly-maize contributed 35 per cent of the productivity followed by mushroom (32 per cent), pigeon (19 per cent) and fish (14 per cent). Cropping with the application of either composted or recycled poultry manure integrating poultry + fish + mushroom resulted in 210 per cent higher productivity than cropping alone with a maximum share from crop (40 per cent) followed by 34 per cent from mushroom.

Integration of cropping applied with composted or recycled pigeon manure + pigeon + fish + mushroom produced 230 per cent higher rice grain equivalent yield than cropping alone. However, only 165 per cent higher productivity was recorded by integration of cropping + fish + mushroom with maximum contribution from crop (41 per cent) and mushroom (40 per cent) in the integration tried. There was a general increase in the productivity of each farming system during 1994-95 with a similar trend of results as that of 1993-94. However, the

Table 1. Water requirement (ha cm) of integrated farming systems

Farming system	Component water requirement (ha cm)					System requirement (ha cm)
	Crop	Poultry	Pigeon	Fish	Mushroom	
FS1 Cropping alone	182	-	-	-	-	182.00 (60.2)
FS2 Crop (CPOM) + Poultry + Fish + Mushroom	201	0.02	-	15.84	1.37	218.23 (143.7)
FS3 Crop (RPOM) + Poultry + Fish + Mushroom	201	0.02	-	15.84	1.37	218.23 (145.1)
FS4 Crop (CPEM) + Pigeon + Fish + Mushroom	201	-	0.04	15.84	1.37	218.23 (154.7)
FS5 Crop (RPEM) + Pigeon + Fish + Mushroom	201	-	0.04	15.84	1.37	218.25 (154.1)
FS6 Crop (MSS) + Fish + Mushroom	201	-	-	15.84	1.37	218.21 (123.1)

(Figure in parentheses indicate rice grain equivalent yield kg ha cm^{-1})

FS1	Rice - greengram - maize	0.50 ha	CPOM	Composted poultry manure
	Rice - sunhemp - maize	0.50 ha	RPOM	Recycled poultry manure
FS2 to FS6	Rice - soybean - sunflower	0.45 ha	CPEM	Composted pigeon manure
	Rice - gingelly - maize	0.45 ha	RPEM	Recycled pigeon manure
			MSS	Mushroom spent substrate

Table 2. Productivity (rice grain equivalent yield) of integrated farming systems

Farming system	Component productivity (kg)					System productivity (kg)
	Crop	Poultry	Pigeon	Fish	Mushroom	
FS1 Cropping alone	10,959	-	-	-	-	10,959
FS2 Crop (CPOM) + Poultry + Fish + Mushroom	12,584	3,493	-	4,677	10,606	31,360
FS3 Crop (RPOM) + Poultry + Fish + Mushroom	12,884	3,493	-	4,677	10,606	31,660
FS4 Crop (CPEM) + Pigeon + Fish + Mushroom	12,118	-	6,459	4,585	10,606	33,768
FS5 Crop (RPEM) + Pigeon + Fish + Mushroom	11,977	-	6,459	4,585	10,606	33,627
FS6 Crop (MSS) + Fish + Mushroom	11,367	-	-	4,892	10,606	26,865

(Figure in parenthesis indicate rice grain equivalent yield kg ha cm^{-1})

FS1	Rice - greengram - maize	0.50 ha	CPOM	Composted poultry manure
	Rice - sunhemp - maize	0.50 ha	RPOM	Recycled poultry manure
S2 to FS6	Rice - soybean - sunflower	0.45 ha	CPEM	Composted pigeon manure
	Rice - gingelly - maize	0.45 ha	RPEM	Recycled pigeon manure
			MSS	Mushroom spent substrate

increase in productivity through integration of cropping with poultry + fish + mushroom, pigeon + fish + mushroom and fish + mushroom was respectively, 168, 188 and 129 per cent higher than cropping alone. The mean over two years also brought out similar trend of productivity response in each farming system.

Integration of poultry and pigeon required very little of water and total water requirement in integration of improved cropping with fish + mushroom + poultry/pigeon, was lesser than the water requirement of cropping alone in one hectare land area. Integrating efficient allied components with cropping results in effective water budgeting with better economic returns in lowland farming.

References

Noble, R.P. and Rashidi, B. (1990). Aquaculture Technology transfer to small holder farmers in Malawi, Southern Africa - NAGA, *The ICLARM Quartly.* **16**: 14-16.

Rangaswamy, A. and Jayanthi, C. (1994). Recycling of organic wastes in integrated farming systems. p.114-118. In. Proc. Natl. Training on organic farming, GOI & Tamil Nadu Agric. Univ. Coimbatore 1-8, Sep., 1994.

Shanmugasundaram, V.S. and Balusamy, M. (1993). Rice-Fish-Azolla. An integrated Farming system in lowlying wetlands. *Farming systems.* **9**: 105-107.

Shanmugasundaram, V.S. and Ravi, K. (1992). Rice + fish + azolla in integration. *NAGA, The ICLARM Quarterly.* **15** (2) : 2-29.

Thanh Hung, LE. (1992). Integration of crustacean aqaculture with coastal rice farming in vietnam-NAGA. *The ICLARM Quartly.* **15**(2): 2-29.

Tiwari, P.N.(1993). Integrated Farming Research for sustaining food production *J. Nuclear Agric, Biol.* **20**: 1-13.

(Received : September 1999; Revised : March 2001)

Madras Agric. J., 87(7-9): 414- 417 July - September 2000

Effect of different organic manures, tillage methods and crop residue management on the availability of micronutrients

K. APPAVU, S. POONGOTHAI AND P. SAVITHRI
Department of Soil Science and Agricultural Chemistry, TNAU, Coimbatore - 641 003, Tamil Nadu

Abstract : Field experiments were conducted with sorghum (Co.26) - soybean (Co.1) cropping sequence in Typic Ustropept soil with different tillage operations and manure treatments. The post harvest soil samples of soybean were analysed for DTPA-Zn, Cu, Fe and Mn content. The results showed that incorporation of organic manures (coirpith, poultry manure, goat manure and FYM) increased the available Zn and Fe content, while the availability of Cu was not influenced by the incorporation of organic manures. Ploughing with country plough and burning the stubbles *in situ* significantly increased the Zn content, while for Fe it was C_2 (country ploughing and composting the stubbles in situ) and for Mn, C_1 and C_2 recorded the highest value. As regards DTPA-Cu, disc ploughing under dry condition recorded the highest value. All the four micronutrient cations were higher in the surface soil than in sub-soil. *(Key words : Sorghum, Soybean, Tillage, Organic manures, Micronutrients.)*

Tillage mixes and incorporates organic debris into the soil. Organic C has been associated with improvements in many soil physical and biological properties including bulk density, aggregation and mineralization of plant nutrients (Bruce *et al.*, 1990). Enhanced respiration and microbial biomass turn over are often observed soon after tillage (Reicosky and Lindstrom, 1993). Dick (1983) observed that mechanical incorporation of fertilizer within the root zone is not possible with no tillage and the nutrient taken up by plant roots from the sub-soil are recycled to the top layer through plant residue mulch. Hence, the present investigation was taken up to assess the effect of different organic manures, tillage methods and crop residue management practices in sorghum-soybean cropping system.