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Awareness and adoption level of recommended technologies of paddy under tank irrigation in Kancheepuram district of Tamil Nadu

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Abstract
The tank irrigation system is one of the oldest and most effective irrigation methods for small and marginal farmers. In India, tank irrigation was adopted by maximum number of farmers, especially in southern Indian states and these states occupy around 60 percent of the total tank irrigated area. Tamil Nadu had a maximum area for cultivation of crops under tank irrigation next to Andhra Pradesh. The study was conducted with 120 tank irrigated paddy farmers in the Kancheepuram district. The overall awareness level of transplanting paddy results revealed that majority (75.80%) of the farmers were under medium level category, while 41.70% of them had medium level of awareness about direct seeding paddy technologies. The overall adoption level results revealed that 51.60% of farmers had medium level adoption of the recommended technologies of transplanting paddy, while 56.70% of farmers were low level adoption of direct seeding paddy in the study area.

Keywords: Tank irrigation, awareness, adoption, transplanting paddy, direct seeding paddy

1. Introduction
Tank irrigation is an old established practice for water conservation in semi-arid tropical parts of India. It is less capital intensive and has wider acceptance compared to major irrigations. Tanks can be effectively used for the development of backward areas (Umamaheshwara. 2009). In agriculture, tank irrigation combines the conservation agenda of indigenous small-scale irrigation systems and the improvement of farmers' livelihoods through the regeneration of farmer management. Tank irrigation is an attractive preposition to farmers because it is estimated the average net return from tank irrigated hectare area in terms of food grains are about three times higher than those from the un-irrigated hectare area (Sengupta, 1993). Paddy is one of the major crops cultivated under tank irrigation in south Indian states. Paddy is grown in our country under four major ecosystems *viz*., irrigated (21.0 m ha), rainfed lowland (14 m ha), rainfed upland (6 m ha) and flood prone (3 m ha). More than half of rice area (55%) is rainfed and distribution wise 80 per cent of the rain fed rice areas are in eastern India, making its cultivation vulnerable to vagaries of monsoon (Anon., 2013). Paddy is cultivated either as a single crop or double crop in tank command areas. To attain maximum field productivity, water must be supplied and regulated in such a way that maximum production could be obtained from the available tank water. This is not happening in the tank command area at present juncture. In fact, the lowest paddy yield per unit area in irrigated land is only from the failed tank irrigated lands (Sivanappan, 1982). A large number of technologies have been generated in paddy cultivation under tank irrigation but the farmers are not adopting to the full extent. With this keeping the above points this study was undertaken to assess the farmer's awareness and adoption level of paddy production technologies under tank irrigation.

2. Materials and Methods
In this study, Expost- facto research design was followed. The study was conducted in Kancheepuram district of Tamil Nadu. This district occupies second position in total number of tanks and also had maximum number of tank irrigated paddy farmers. In Kancheepuram district, Uthiramerur, Walajabad, Maduranthagam, and Sriperumbudur blocks were selected based on the major area under tank irrigated cultivation. These four blocks covers around 80% of total net irrigated area under tanks and also covers total paddy cultivated area under tank irrigation. The respondents of 120 tank irrigated paddy farmers were selected from four blocks based on proportionate random sampling technique as follows.

Table 1: Distribution of tank irrigated paddy farmers in the selected blocks

S.no	Name of blocks	Number of tank irrigated paddy farmers	Number of farmers selected by Proportionate Random sampling technique
1	Uthiramerur	8531	37
2	Walajabad	6724	30
3	Maduranthgam	6436	28
4	Sriperumbudur	5431	24
Total		27,190	120

***Source*:** Assistant Director of Agriculture Office of Uthiramerur, Walajabad, Maduranthagam, and Sriperumbudur blocks

The package of practices from sowing to harvesting were collected from literature and based on the discussion made with paddy scientist and the awareness and adoption level was measured among 120 tank irrigated paddy farmers.

3. Result and Discussions

3.1 Awareness and Adoption level of paddy under tank irrigation

3.1.1 Overall Awareness level of paddy under tank irrigation

By using cumulative frequency method farmers were categorized as low, medium and high level of awareness about recommended technologies of paddy under tank irrigation

Table 2: Distribution of respondents according to their Overall awareness of transplanting paddy under tank irrigation

(n=120*)

S. No	Category	Number	Per cent
1	Low level of awareness	14	11.70
2	Medium level of awareness	91	75.80
3	High level of awareness	15	12.50
Total		120	100.00

It could be seen from table 2 that more than three fourth (75.80%) of the tank irrigated paddy farmers had medium level of awareness, while 12.50 percent and 11.70 percent of them had high level of awareness and low level of awareness respectively. Most of the paddy farmers had medium to a high level of information-seeking behavior and farming experience might be the reasons for most of the tank irrigation farmers are possessing medium to a high level of awareness about transplanting paddy.

Table 3: Distribution of respondents according to their Overall awareness of direct seeding paddy under tank irrigation

(n=120*)

S. No	Category	Number	Per cent
1	Low level of awareness	33	27.50
2	Medium level of awareness	50	41.70
3	High level of awareness	37	30.80
Total		120	100.00

From table 3 shows that 41.70% of the respondents had medium level of awareness, while 30.80% and 27.50% of them had high level and low level of awareness about direct seeding paddy respectively. Majority of the tank irrigated paddy farmers had medium to a high level of awareness about direct sowing paddy.

3.1.2 Overall adoption level of paddy under tank irrigation

Table 4: Distribution of respondents according to their Overall adoption level of transplanting paddy under tank irrigation

(n=120*)

S. No	Category	Number	Per cent
1	Low level of adoption	30	25.00
2	Medium level of adoption	62	51.60
3	High level of adoption	28	23.40
Total		120	100.00

The overall analysis of table 4 inferred that 51.60 percent had medium level of adoption followed by low level adoption (25.00%) and high level adoption (23.40%). Due to early/ late onset of north-east monsoon, erratic rainfall and occasional visits by extension officials are the reasons for medium-to-low-level adoption.

Table 5: Distribution of respondents according to their Overall adoption level of direct seeding paddy under tank irrigation

(n=120*)

S. No	Category	Number	Per cent
1	Low level of adoption	68	56.70
2	Medium level of adoption	34	28.30
3	High level of adoption	18	15.00
Total		120	100.00

From table 5 shows that majority (56.70%) of the respondents had adopted low level of direct seeding paddy technologies, 28.30 percent and 15.00 percent had medium and high level level adoption of direct seeding paddy technologies respectively. The reasons for low level of adoption would be lack of knowledge on technologies such as seed hardening, PPFM, seed drill sowing, pest, and disease management.

3.1.3 Technology-wise awareness and adoption level of paddy under tank irrigation

Table 6: Distribution of respondents according to Awareness and Adoption level of paddy under tank irrigation

(n=120*)

S.no	Technology	Awareness		Adoption	
i).	Transplanting paddy	Frequency	percent	Frequency	percent
I	Crop improvement technology				
1.	Varieties – ADT 37, ADT38, TKM13, CO52, white ponni, CO48, MDU5	108	90.00	93	77.50
II	Crop production technologies				
1.	Nursery area - 20cents (800 sq.m)	102	85.00	81	67.50
2.	Seed rate – 40kg//ha and 60kg/ha	108	90.00	59	49.20
3.	Seed treatment - Biofertilizers like five packets of Azophos.	111	92.50	81	67.50

4.	Sowing – uniformly in seedbed	111	92.50	102	85.00
5.	Seedling age - 18-22 days for short, 25-30 days for medium and 35-40 days for long duration varieties	114	95.00	96	80.00
6.	Mainfield preparation- 2.5 cm depth water during puddling	102	85.00	69	57.50
7.	No.of seedlings /hill- 2--3	108	90.00	42	35.00
8.	Spacing- 15 x 10 cm and 20 x 10 cm	105	87.50	81	67.50
9.	Gap filling -7 to 10 days	93	77.50	33	27.50
III	**Nutrient management**				
1.	FYM/ Green leaf manure- 12.5t/ha	108	90.00	72	60.00
2.	NPK-150:50:50 kg/ha	93	77.50	36	30.00
3.	Fertilizer Application time	63	52.50	12	10.00
4.	Application method- broadcasting	120	100.00	114	95.00
ii).	**Direct sowing paddy**				
1.	Varieties – MDU5,CO47,ADT37	72	60.00	9	7.50
2.	Season – july to august	78	65.00	12	10.00
3.	Field preparation-summer ploughing	60	50.00	0	0
4.	Seed rate-75kg/ha	81	67.50	15	12.50
5.	Seed hardening-1% kcl	59	49.50	0	0
6.	Seed treatment – pseudomonas 10g/kg of seed and Azophos 1kg/ha	84	70.00	21	17.50
7.	Sowing by seed drill	60	50.00	12	10.00
8.	Sowing by drum seeder	81	67.50	54	45.00
9.	Thinning and gap filling- 14 to 21 days after sowing	57	47.50	54	45.00
10.	PPFM (foliar spray 1%)	84	70.00	0	0
11.	NPK (75:25:37.5 kg/ha)	30	25.00	11	9.20
IV	**Plant protection technologies**				
a.	**Weed management**				
1.	hand weeding	120	100.00	96	80.00
2.	Herbicide –Pre-emergence at 30DAT	111	92.50	84	70.00
3.	Rotary weeder - finger type single row and double row	90	75.00	39	32.50
b.	**Pests and their management**				
1.	Thrips - (Spray Monocrotophos - 40 ml Thiamethoxam -25% WG 4g	99	82.50	72	60.00
2.	Yellow stemborer (spray Carbofuran 3% CG 25 kg)	108	90.00	72	60.00
3.	Greenleaf hopper – (Broadcast carbofuran 3% CG 3.5 kg in 20 cents)	108	90.00	99	82.50
4.	Brown plant hopper (spray Imidacloprid 70% WG 30-35 kg).	111	92.50	78	65.00
5.	Leaf folder (spray Chlorpyriphos 20% EC 1250 ml)	108	90.00	96	80.00
6.	Rat (Poison bait at 1 part zinc phosphide with 49 parts popped corn/rice/dry fish).	96	80.00	106	88.30
c.	**Diseases and their management**				
1	Paddy blast (Spray Azoxystrobin 25 SC @ 500 ml/ha)	96	80.00	72	60.00
2	Bacterial leaf blight (Spray copper oxychloride @ 1.25 kg/ha)	111	92.50	97	80.80
2	Sheath blight(Spray bavistin 1g/litre or Spray carbendazim 50 WP @ 500 g/ha)	108	90.00	76	63.30
3	False smut(Two sprays with propiconazole 25 EC @ 500 ml/ha)	87	72.50	66	55.00
4	Sheath rot (Spray carbendazim @ 500 g/ha)	65	54.20	23	19.20
5	Grain discolouration (Spray carbendazim + thiram + mancozeb (1:1:1) @ 0.2% at 50% flowering stage)	89	74.20	70	58.30
V.	**Water management**				
1.	Irrigation (30 to 35 days) Irrigate to 5 cm depth.	99	82.50	75	62.50
VII	**Harvesting**				
1.	Hand harvest (80% of the panicles turn straw colour)	120	100.00	105	87.50
2.	Machine harvest	81	67.50	54	45.00

(*) Multiple responses obtained

3.2 Technology-wise Awareness level of paddy under tank irrigation

3.2.1 Awareness level of transplanting paddy crop improvement technologies under tank irrigation

The results of awareness about varieties revealed that majority (90.00%) of the respondents had awareness about the recommended varieties namely ADT 38, ADT39, TKM13, CO52, white ponni, CO48 and MDU5. Majority of the farmers had medium to a high level of contact with mass media exposure and extension agents might be the reason for this high awareness level.

3.2.2 Awareness level of transplanting paddy crop production technologies

It could be seen from table 2 that more than four-fifths (85.00%) of respondents were aware of the recommended nursery area of 20 cents for paddy cultivation, while 90.00% of them were aware about recommended seed rate of transplanting paddy. Also majority of the tank irrigated paddy farmers were aware (92.50%) about seed treatment practices with bio-fertilizers and fungicides and seed sowing practices. 95.00% of them were aware about recommended seedling age for transplanting paddy, 85.00% of the tank irrigated paddy farmers were aware of recommended main field preparation of 2.5 cm depth water during puddling. 90.00 percent of the them were aware about numbers of seedlings /hill for transplanting and 87.50% of the paddy farmers were aware about the recommended spacing for transplanting, 77.50 percent of them were aware about recommended gap-filling time (7 to 10 days after planting).

3.2.3 Awareness level of transplanting paddy crop nutrient management

The results of awareness about manures and fertilizers inferred that 90.00% of farmers were aware about recommended FYM,/ Green leaf manure, 77.50% of them were aware about recommended NPK fertilizers, more than half of the paddy farmers were aware about fertilizer application time and all tank irrigated paddy farmers were aware about fertilizer application method.

3.2.4 Awareness level of direct seeding paddy under tank irrigation

It could be concluded that three-fifth (60.00%) of the paddy farmers were aware about MDU5, CO47, IR64, ADT37, and local landraces varieties, more than three-fifth (65.00%) of the respondents were aware about the normal season for cultivation, 50.00% of the respondents were aware about summer ploughing, 67.50% percent of them were aware about seed rate of 75 kg/ha, 49.50 percent of them were aware about seed hardening chemicals (1% kcl) less than three- fourth (70.00%) of the respondents were aware about seed treatment, 50.00 percent and 67.50 percent of them were aware about drill sowing and drum seeder sowing method, 70.00 percent of the respondents were aware about PPFM culture and one-fourth of the respondents were aware about recommended dosage of NPK fertilizers. Practices such as drill sowing, PPFM and the recommended fertilizers dosage are aware by a fewer number of farmers only.

3.2.5 Awareness level of paddy plant protection technologies under tank irrigation

Regarding weed management practices, the results stated that cent percent of the respondents were aware about hand weeding practices, while 92.50% of them were aware about weed management by herbicide application and 75.00% of the paddy farmers were aware about rotary weeder.

3.2.6 Awareness level of paddy pests and their management practices

The results of awareness about pest management practices indicated that majority (82.50%) of the paddy farmers were aware about thrips and their management practices, while 90.00 percent of them had awareness about yellow stem borer and their management practices, 90.00% about green leafhopper and their management practices, 92.50 percent, 90.00 percent and 80.00 percent of them were aware about pests like brown plant hopper, leaf folder and rat and their management practices respectively.

3.2.7 Awareness level of paddy diseases and their control measures

The findings of awareness about disease management practices confessed that 80.00% of the tank irrigated paddy growers had awareness about disease like paddy blast and their control measures, 92.50 percent of them had awareness about bacterial leaf blight and their control measures, 90.00% about sheath blight and their control measures, 72.50 percent, 54.20 percent and 74.20 percent of them were aware about diseases like false smut, sheath rot and grain discoloration and their control measures respectively.

3.2.8 Awareness level of paddy crop water management and harvest practices

Regarding water management and harvesting practices, 82.50 percent of tank irrigated paddy farmers were aware about recommended Irrigation period and Irrigation, while cent percent and 67.50 percent of tank irrigated paddy farmers were aware about hand harvest and machine harvest respectively.

3.3. Technology-wise Adoption level of paddy under tank irrigation

3.3.1 Adoption level of transplanting paddy crop improvement technologies under tank irrigation

The results of adoption about varieties stated that more than three-fourth of the farmers had adopted the recommended varieties of ADT 38, ADT39, TKM13, CO52, white ponni, CO48, MDU5. Medium to a high level of contact with water user associations and extension agents might be reason for majority of tank irrigated paddy farmers adopted these varieties.

3.3.2 Adoption level of transplanting paddy crop production technologies

The findings of adoption about transplanting paddy production technologies revealed that 67.50 percent of farmers had adopted the nursery area of 20 cents, while 49.20 percent of them had adopted the seed rates, 67.50 percent of farmers adopted the recommended seed treatments like bio-fertilizers and fungicides, majority 85.00 percent of them adopted the recommended sowing method, 57.50 per cent of farmers had reported having adopted the recommended transplanting seedling age, 57.50 percent adopted recommended main field preparation of water depth during puddling, while 35.00 percent,67.50 percent and 27.50 percent of tank irrigated paddy farmers adopted seedlings per hill, transplanting spacing for sowing and gap-filling respectively.

3.3.3 Adoption level of transplanting paddy nutrient management technologies

Three-fifth of the respondents adopted the recommended dosage of FYM/ Green leaf manure, 30.00% of them had adopted the recommended dosage of NPK fertilizers, 10.00 percent of respondents adopted the recommended application time of fertilizers and 95.00 percent of farmers adopted broadcasting method of application.

3.3.4 Adoption level of direct seeding paddy under tank irrigation

The findings of direct seeding paddy technologies revealed that 7.50 percent of the farmers adopted the recommended varieties such as MDU5, CO47, IR64, ADT37 and local landraces, 10.00 percent of the farmers adopted the normal season of cultivation, 12.50 percent of them had adopted the seed rate of 75kg/ha, 17.50 percent of farmers had adopted the seed treatment practices with Pseudomonas, Azospirillum and Azophos, 10.00%, 45.00% and 9.20% of them adopted drill sowing, drum seeding technique and recommended dosage of NPK fertilizers.

3.3.5 Adoption level of plant protection technologies of paddy under tank irrigation

Regarding weed management, 80.00 per cent of the farmers had adopted hand weeding practices, while 70.00 percent and 32.50 percent of them had adopted the recommended application of herbicide and the rotary weeder technology. The lack of awareness and knowledge would be a reason for less number of adoption of weed management by rotary weeder.

3.3.6 Adoption level of paddy pests and their management practices

The results about adoption practices of paddy pests and their management revealed that three-fifth of the farmers had adopted the recommended management practices for both thrips and yellow stem borer, 82.50 percent of them had adopted the recommended management practices for green leafhopper, 65.00 percent, 80.00 percent and 88.30% of them had adopted the recommended management practices for brown plant hopper, leaf folder and rat respectively.

3.3.7 Adoption level of paddy diseases and their control measures

The findings about adoption practices of paddy disease and their protection measures inferred that 60.00% of the tank irrigated paddy farmers had adopted the recommended protection measures of paddy blast, while 80.80 percent of the farmers had adopted the recommended protection measures of bacterial leaf blight, (63.30%) sheath blight protection measures, 55.00 percent, 19.20% and 58.30% of farmers had adopted the false smut, sheath rot and grain discoloration protection measures respectively.

3.3.8 Adoption level of paddy crop water management and harvest practices

Regarding water management and harvest practices, 62.50% of tank irrigated paddy farmers had adopted the recommended schedule and depth of irrigation, while the majority (87.50%) and 45.00 percent of paddy farmers had adopted the recommended hand-harvest practices and machine harvest technology.

4. Conclusion

It could be concluded that, overall awareness and adoption level of transplanting paddy confessed that most of the tank irrigated paddy farmers belonged to medium to high level category and for direct seeding paddy revealed that majority of farmers belonged to medium to low level awareness and adoption category. Therefore, researcher and subject-matter specialists may conduct training to create awareness and to make understanding the complex practices in tank irrigated farming. Also extension personal has to conduct the field visits and demonstration and exhibitions to provide first-hand information to motivate them to practice these technologies for higher percentage of adoption in tank irrigated paddy farming.

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