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Evaluation of Knowledge Level of Farmers on Package of Practices for Composite Fish Culture in Papum Pare District of Arunachal Pradesh, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

An investigation on impact of training and demonstration programme on composite fish culture (CFC), for farmers of Papum Pare district Arunachal Pradesh, were undertaken to ascertain technical knowhow on standard package of practices for successful CFC with six parameters viz, 1. Fish species selection, 2. Fish species ratio combination, 3. Fish seed stocking stages (fry and fingerling) 4. Fry/fingerling treatment (NaCl), 5. Fish stocking density, 6. Pre and post-stocking management. Six villages were selected namely: Mani, Midpu, Chiputa, Balapu, Emchi and Upper Jumi.; 30 fish farmers from each village comprising 180 farmers were part of investigation. As per the baseline survey in the beginning on average 80% of farmers had a low level of knowledge about fish species selection followed by 12% medium and 8 % high. 82% had a low level of knowledge about, fish species ratio combination, 10% medium and only 8% had high knowledge on CFC. 81% had a low level of knowledge on fish seed stocking stages (fry and fingerling) followed by 10% and 9% respectively for medium and high. 91% had a low level of knowledge on fry/fingerling treatment (NaCl), followed by 6% medium and 3% high. 78% had low knowledge on fish stocking density followed by 13% and 9% for medium and high. 86% had low knowledge on pre- and post stocking management followed by 8% and 6% for medium and high respectively. After imparting training and Front line demonstration (FLD) programme at farmers door step on successive year, knowledge on fish species selection for low medium and high was 9%, 11% and 80 % respectively. 20%, 41% and 39% for low, medium and high on fish species ratio combination, 9%, 13% and 78% on fish seed stocking stages. 16%, 36% and 48% for low, medium and high knowledge on fry/fingerling treatment (NaCl), 11%, 19% and 70 % for low, medium and high knowledge on fish stocking density and 15%, 21% and 64% for low, medium and high knowledge on Pre and post-stocking management. Average fish production increase from 0.78 tone/ha/yr to 1.54 tone/ha/yr (97.4% increase) after imparting training and demonstration, which implies training and demonstration on CFC has significant impact on increase fish production per hectare of pond, through the power of knowledge gained by farmers on technical knowhow on CFC.

Keywords: Training; knowledge; impact analysis; package of practices; composite fish culture.

1. INTRODUCTION

India is blessed with huge potential for fishery productions and the technique of fish culture or fish farming vary from region to region and place to place by farmers, which suits the location specific practices, evolved through trial and error methods since ages. Such location specific best suited technique for fish culture in Arunachal Pradesh is paddy cum fish culture, practices by Apatani tribes of Arunachal [1]. To augment fish productivity several technologies, packages of practise are available, one of the best among many is composite fish culture (CFC) practices/technique. In this technology five or six different types of fish species are cultured together in a single pond. Fishes with their different food habitats are selected and cultivated, so they don't fight or compete with each other for food resources. Similarly, Håstein [2] explain that, composite fish culture or mixed farming or polyculture is based on the principle that compatible species do not harm each other, instead they utilise in the most efficient manner, all available food supply of the pond, for maximum production of fish yield [3]. There is no competition between different species; on the other hand, they may have a beneficial effect on the growth of others. *Catla*, *Rohu* and *Mrigal* are stocked in the ratio of 3:3:4 to give good yield from the ponds Morton, et al., [4]; Naylor, et al., [5]; Padhi, et al. [6]. Culturing of a single species is not profitable as one does not get the most from the particular water body. Therefore, a group of fishes are selected; each having different feeding habits from others so that all the food available in the different zones of the pond is used profitably Avnimelech et al., [7]; Talukdar and Sontaki [8].Similar finding observed by stocking three Indian major carps *(Catla, Labeo, Cirrhina)* in the same pond, is an excellent example of the appropriate selection of species for the maximum utilisation of the food from the different zones of the pond. *Catla*is the surface feeder and feeds mainly on the zooplankton and detritus, whereas, *C. mrigala and L. calbasu* are bottom feeders [9]. Based on their compatibility and dietary preferences, the following species of both Indian and Exotic carp have been suggested for cultivation in the composite fish farming technology Sinha et al., [10]. Both the catla and silver carp are surface-feeding species. Catla primarily consumes zooplankton, whereas silver carp favor phytoplankton, offering both

ecological and socio-economic benefits due to their significant influence on pond ecosystems, being fast-growing and highly efficient in filtration Lazzaro [11] and Milstein [12]. Grass carp are known for their ability to consume low-value plant matter, thereby enhancing natural food production in the pond through nutrient recycling and the production of fecal matter Li et al. [13]. Mrigal, on the other hand, is a bottom-dwelling species that is often used for monitoring the condition and health of fish farms Ahmed et al. [14]. The common carp is recognized for its swift growth rate and is referred to as a bioturbator, as it not only increases the availability of food but also alters the feeding habits and food consumption patterns of Rohu Anras et al. [15].

The Indian government has undertaking a number of agricultural reforms projects and plans to boost fishery production with aim to improve the national economy as well as for doubling farmers income. However, many programmes are not exhibiting major changes in realization of higher productions of fish [16]. The lack of providing precise training and demonstration on location-specific technology and package of practices to the farmers may be responsible for failure to materialize and realize the goal or objective set by government to improve fish production and productivity. This background study has undertaken to evaluate the knowledge level of farmers on a package of practices for composite fish culture in Papumpare district of Arunachal Pradesh, North east, India [17].

2. MATERIALS AND METHODS

Six villages were selected base on fish production record of village namely: Mani, Midpu, Chiputa, Balapu, Emchi and Upper Jumi. Thirty (30) active fish farmers from each village were selected to evaluate knowledge level of farmers on package of practices on composite fish culture (CFC**)**, total comprising of 180 farmers. Gender and different age group ratio proportion were not considered during farmers selection, only active fish farmers were sole criteria in farmers selection. A uniform questionnaire on standard management package of practices on CFC was prepared with six parameters Viz. 1. Fish species selection, 2. Fish species ratio combination, 3. Fish seed stocking stages (fry and fingerling), 4. Fry/fingerling treatment (NaCl), 5. Fish stocking density, 6. Pre- and post-stocking management, to know the level of technical knowhow on CFC. Farm and home visit along with group discussion were followed to evaluate individual knowledge on CFC. Two training programme of 3 days each and two frontline demonstration (FLD) were organized in each village after completion of baseline survey and evaluation of questionnaire on CFC, the training and demonstrations was done as per the standard management practices given in(Table 1 and Fig. 2) and after one year same questionnaire were evaluated to all the farmers (180) following similar mode of approaches as earlier, to evaluate the percentage change in knowledge on CFC and fish productivity.

3. RESULTS AND DISCUSSION

As per base line survey on different composite fish culture (CFC), shown in Table 1. The fish species selection was not followed by farmers, it was based on the availability of fish in market or seasons. Fish species ratio was never maintained as per the availability of species put into pond. Fry or fingerlings were used as fish seed stocking stages in all the villages and stocking density ranged from 10000-30000 per hectare. Fingerling treatment and Pre and post-stocking management was not followed in any village, despite some farmers knew about the practices from some other source. Source of fish seed was from local vendor, so they were not aware of quality of fish seed. However, some time few numbers of fish are supplied by state governments. The fish production ranges from 0.72 to 0.84 tone/ha/yr.

The knowledge evaluations before training and demonstration on packages of practices on CFC, on different parameters are shown in Table 3.

Fish species selection: Upper Jumi fish farmers had lowest knowledge of fish species selection with 85% out of 30 farmers followed by Balapu farmers 83%, Midpu 82%, Mani 80%, Chiputa 79% and Emchi 75%. Medium knowledge was recorded highest in Mani farmers 14%, Emchi, Midpu and Chiputa with 12% each and 7% each in Balapu and Upper Jumi. Farmers of Emchi had highest knowledge of selection of fish species with 12 % followed by Chiputa 9%, Midpu and Balapu 7% each, Mani 6% and upper Jumi 5%.

Fish species ratio combination (FSRC): Lowest knowledge on FSRC was recorded in Balapu 85%, Upper Jumi 84% followed by Mani, MidpuChiputa and Emchi, 82%, 81%, 80% and 79% respectively. Medium knowledge with highest percentage was recorded in Chiputa 12% and lowest in Emchi and Balapu village with 9% each. Emchi village had highest knowledge on

FSRC with 12% followed by Midpu and Chiputa 8% each, and Mani, Balapu and Upper Jumi with 6% each.

Fish seed stocking stages (fry and fingerling): Lowest knowledge on fish seed stocking stages (FSSS) was recorded in Upper Jumi 90% followed by Balapu 89%, Midpu 85%, Mani 84%, Chiputa 81% and Emchi 79%. Medium knowledge on FSSS was highest for Emchi with 12% followed by Chiputa, Mani and Midpu, 10%, 9%, and 8% respectively and Balapu and Upper Jumi with 6% each. Highest level of Knowledge on FSSS was for Emchi farmers with 13% followed by Chiputa and Mani 9% each, Midpu 8%, Balapu 5% and Upper Jumi 4%

Fry/fingerling treatment with (NaCl): 98% of Balapu farmers had no knowledge on fry/fingerling treatment with (NaCl) followed by Upper Jumi 96%, Mani 92%, Midpu 90%, Chiputa 89% and Emchi 87%. Emchi and Chiputa sharing 7% each has highest medium knowledge on fry/fingerling treatment with (NaCl) followed by Midpu, Mani, Upper Jumi and Balapu 6%, 5%, 3% and 1% respectively. Emchi 6%, Midpu and Chiputa 4% each followed by Mani 3%, Balapu and Upper Jumi with 1% each.

Fish stocking density (FSD): Lowest level of knowledge was recorded in Upper Jumi 88% followed by Balapu 87%, Mani 79%, Emchi and Midpu 77% each and Chiputa 75%. Mediun level of knowledge was more in Chiputa 17% followed by Midpu 13%, Mani 12%, Emchi and Balapu with 10% each and Upper Jumi 8%. Highest level of knowledge was recorded in Emchi 13% followed by Midpu 10%, Mani 9%, Chiputa 8%, upper Jumi 4% and Balapu 3%.

Pre- and post-stocking management (PPSM): Lowest level of knowledge was recorded in Balapu 98% followed by Upper Jumi 96%, Mani 86%, Midpu 85%, Chiputa 83% and Emchi 80%. Medium level of knowledge was highest in Chiputa 11%, Midpu and Emchi with 8% each, Mani 7%, Upper Jumi 3% and Balapu 2%. Highest level of knowledge was found in Emchi 14%, Mani and Midpu 7% each, Chiputa 6%, Upper Jumi 1% and Balapu with nil (0%) knowledge.

On average the highest percentage of lowest knowledge in all the six undertaken parameters accessed on package of practices on CFC was recorded in Upper Jhumi and Balapu village of farmers, out of six selected villaged. The lowest knowledge on technical knowhow of farmers in said two villages may be due to geographical isolation from state capital and district headquarter as compare to rest four villages. The four villages (Emchi, Mani, Midpu and Chiputa) are not only near to state capital and district headquarter but also near to Assam boarder (Harmuti Market), being placed in geographical location advantages, the farmers may have easy access to state fishery departments for logistic support and exposure to fish farming technique from bordering area of Assam.

Average knowledge level of farmers before imparting training as shown in Table 3, revealed that 91% of farmers had lowest knowledge on fry/fingerling treatment (NaCl), 164 farmers out of total 180 farmers. Medium knowledge was highest for fish stocking density 13% (24 out of 180 farmers), similarly, fish stocking density and fish seed stocking stages (fry and fingerling) knowledge of farmers had highest at about 9% each.

Knowledge level of farmers had drastically improved over one year, after imparting training and demonstrations Table 5.

Knowledge level on fish species selection for the lowest level of knowledge was highest in Upper Jumi11% followed by Emchi and Mani 10% each, Balapu 9%, Midpu 8% and Chiputa 6%. Medium level of knowledge was highest in upper Jumi with 14%, Balapu and Mani with 11% each, Midpu 10% and Emchi 8%. Highest knowledge was recorded in Chiputa with 85%, followed by Emchi and Midpu with 82% each, Mani 79% and Upper Jumi with75%.

Fish species ratio combination: Lowest knowledge level onfish species ratio combination was highest in Upper Jumi and Midpu with 21% each followed by Mani 20%, Emchi and Balapu 19% each and Chiputa 18%. Medium level of knowledge was highest in Balapu 43% followed by Midpu 42%, Mani 41% and 40% each in Chiputa, Emchi and Upper Jumi. Highest level of knowledge was for Chiputa 42% followed by Emchi 41%, Mani and Upper Jumi 39% each, Balapu 38% and Midpu 36%. Percentage change in knowledge on fish species combination was comparatively very less than change in other parameter, this may due to problem of farmers to understand the ratio proportion of different fish species to be maintained at pond for better productivity with judicious use of space.

Table 1. Base line survey on fish production managements and yield per hectare/pond in year 2021

Sr. No.	Parameters	Villages					
		Midpu	**Mani**	**Chiputa**	**Balapu**	**Emchi**	**Upper Jumi**
1.	Fish species	As per availability in the market	As per availability in the market	As per availability in the market	As per availability in the market	As per availability in the market	As per availability in the market
2	Species ratio	None	None	None	None	None	None
3	Fish seed stocking stages	fry or fingerling	fry or fingerling	fry or fingerling	fry or fingerling	fry or fingerling	fry or fingerling
4	Stocking density	20000 -30000/ha	25000 -30000/ha	10000 -25000/ha	20000 -30000/ha	26000 -30000/ha	10000 -30000/ha
5	Fingerling treatment	None	None	None	None	None	None
6	Pre and post-stocking management	None	None	None	None	None	None
7	Source of fish seed	Local Vendors	Local Vendors	Local Vendors	Local Vendors	Local Vendors	Local Vendors
8	Quality of fish seed	As per availability in the market	As per availability in the market	As per availability in the market	As per availability in the market	As per availability in the market	As per availability in the market
9	Avg. Production (Tone/Ha)	0.76	0.81	0.75	0.84	0.72	0.79

Table 2. Standard packages of practices for composite fish culture (CFC)

Sr. No.	Parameters	Demonstration practice
1	Fish species	Catla, Rohu, and Mrigal
2	Species ratio	4:3:3
3	Fish seed stocking stages	Advanced fingerling
4	Stocking density	7000/ha
5	Fingerling treatment	Treatment with a common salt solution
6	Pre- and post-stocking management	Pre- and post-stocking management is done.
7	Source of fish seed	Govt. Hatchery/NFDB registered farm
8	Quality of fish seed	Good quality

Table 3. Knowledge of farmers on CFC before training

Sr. No.	Parameters	Knowledge of farmers on CFC before training																	
		Midpu			Mani			Chiputa			Balapu			Emchi			Upper Jumi		
		L%	M%	H%	L%	M%	H%	L%	M%	H%	L%	M%	H%	L%	M%	H%	L%	M%	H%
1	Fish species selection	81	12	7	80	14	6	79	12	9	83	10	7	75	13	12	85	10	5
2	Fish species ratio combination	81	11	8	82	12	6	80	12	8	85	9	6	79	9	12	84	10	6
3	Fish seed stocking stages (fry and fingerling)	85	8	7	84	9	7	81	10	9	89	6	5	75	12	13	90	6	4
4	Fry/fingerling treatment (NaCl)	90	6	4	92	5	3	89	7	4	98	1	1	87	7	6	96	3	1
5	Fish stocking density	77	13	10	79	12	9	75	17	8	87	10	3	77	10	13	88	8	4
6	Pre- and post-stocking management	85	8	7	86	7	6	83	11	6	98	2	0	80	8	14	96	3	1

**L=Low, M=Medium, H=High*

Table 4. Average Knowledge of fish farmer on CFC before training N=180

Sr. No.	Parameters	Low		Medium		High	
		No.	%	No.	%	No.	%
1	Fish species selection	144	80	22	12	14	8
2	Fish species ratio combination	148	82	18	10	14	8
3	Fish seed stocking stages (fry and fingerling)	146	81	18	10	16	9
4	Fry/fingerling treatment (NaCl)	164	91	11	6	5	3
5	Fish stocking density	140	78	24	13	16	9
6	Pre and Post stocking management	155	86	14	8	11	6

Table 5. Knowledge level of farmers on CFC after training.

Sr. No.	Parameters	Knowledge of farmers on CFC after training																	
		Midpu			Mani			Chiputa			Balapu			Emchi			Upper Jumi		
		L%	M%	H%	L%	M%	H%	L%	M%	H%	L%	M%	H%	L%	M%	H%	L%	M%	H%
1	Fish species selection	8	10	82	10	11	79	6	9	85	9	11	80	10	8	82	11	14	75
2	Fish species ratio combination	21	42	36	20	41	39	18	40	42	19	43	38	19	40	41	21	40	39
3	Fish seed stocking stages (fry and fingerling)	7	15	78	8	17	75	10	13	77	7	13	80	9	12	79	11	11	78
4	Fry/fingerling treatment (NaCl)	16	36	48	13	38	49	15	35	50	17	37	46	14	35	51	18	38	44
5	Fish stocking density	12	18	70	10	19	71	14	14	72	12	19	69	7	20	73	11	21	68
6	Pre and post-stocking management	16	22	62	15	20	65	18	20	62	12	18	70	10	25	65	20	21	59

Table 6. Avg. knowledge of fish farmer on CFC after training. N=180

Sr. No.	Parameters	Low		Medium		High	
		No.	%	No.	%	No.	%
1	Fish species selection	16	9	20	11	144	80
2	Fish species ratio combination	36	20	74	41	70	39
3	Fish seed stocking stages (fry and fingerling)	16	9	24	13	140	78
4	Fry/fingerling treatment (NaCl)	29	16	65	36	86	48
5	Fish stocking density	20	11	34	19	126	70
6	Pre and Post stocking management	27	15	38	21	115	64

NB. No.= Number of farmers

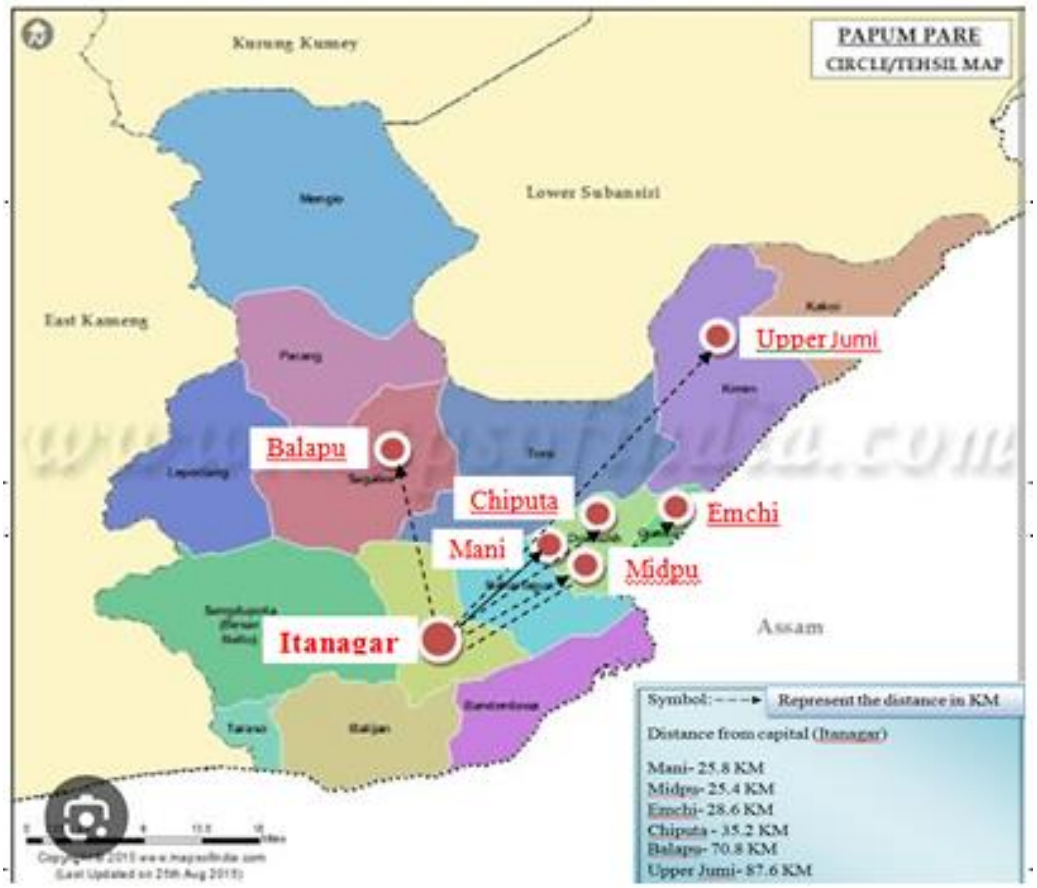

Fig. 1. Arunachal Map showing investigation village with distance from state capital and District headquarter

Mani=25.8Km, Midpu= 25.4 Km, Emchi=28.6 Km, Chiputa=35.2 Km, Balapu=70.8Km,UpperJumi=87.6Km

Picture 1. Training on CFC

Picture 2. Demonstration and distribution of fingerlings

Picture 3. Diagnostic visit at farmers field

Picture 4. Fishery day celebrations at farmers field

Fig. 2. Training, demonstration and other activities organized for fish farmers

Fish seed stocking stages (fry and fingerling): Lowest knowledge on fish seed stocking stages was recorded in Upper Jumi 11% followed by Chiputa 10%, Emchi 9%, Mani 8%, Midpu and Balapu with 7% each. Medium knowledge was recorded highest in Mani 17%, Midpu 15%, Chiputa and Balapu 13% each, Emchi 12% and Upper Jumi 11%. Highest level of knowledge recorded in Balapu 80% followed by Emchi 79%, Midpu and Upper Jumi 78% each, Chiputa 77% and Mani 75%.

Fry/fingerling treatment (NaCl): Upper Jumi with 18% had a most percentage share of lowest knowledge on fry/fingerling treatment (NaCl), followed by Balapu with 17%, Midpu 16%, Chiputa 15%, Emchi 14% and Mani 13%. Medium knowledge level was recorded highest in Mani and Upper Jumi with 38% each, followed by Balapu 37%, Midpu 36%, Chiputa and Emchi 35% each. Emchi with 51% recorded the highest level of knowledge on fry/fingerling treatment (NaCl), followed by Chiputa 50%, Mani 49%, Midpu 48%, Balapu 46% and Upper Jumi 44%.

Fish stocking density: Chiputa with 14% had a most percentage share of lowest level of knowledge on fish stocking density followed by Midpu and Balapu 12% each, Upper Jumi 11%, Mani 10% and Emchi 7%. Medium level of knowledge was highest in Upper Jumi 21%, Emchi 20%, Mani and Balapu 19% each, Midpu 18% and Chiputa 14%. Emchi with 73% recorded the highest level of knowledge on fish stocking density, followed by Chiputa 72%, Mani 71%, Midpu 70%, Balapu 69% and Upper Jumi 68%.

Pre and post-stocking management: Upper Jumi with 20% share the highest percentage of lowest level of knowledge on Pre and post-stocking management followed by Chiputa 18%, Midpu 16, Mani 15%, Balapu 12% and Emchi 10%. Medium knowledge level was recorded highest in Emchi 25% followed by Mani 22%, Upper Jumi 21%, Mani and Chiputa with 20% each and Balapu 18%. Highest level of knowledge was recorded in Balapu 70%, followed by Mani and Emchi with 65% each, Midpu and Chiputa 62% each and Upper Jumi with 59%.

Average knowledge level of farmers after imparting training shown in Table 6. It is revealed that 20% of farmers had lowest knowledge on fish species ratio combination amongst six undertaken parameters with 36 farmers out of 180 farmers. Similarly, medium knowledge was highest again for fish species ratio combination with 41% (74 out of 180 farmers). Fish species selection level of knowledge had highest with 80% (144 farmers out of 180 farmers), indicating great improvement in knowledge level of farmer after training and demonstrations on CFC. Average fish yield increased by 97.43% from 0.78 tone/ha to 1.54 tone/ha/yr after training and demonstration with average extension gap (EP) of 0.76 tone/ha/yr (Table 8). Alikunhi and Chaudhuri (1957) have also reported that fish production is higher in CFC compare to traditional method of fish productions.

Comparative assessment of percentage change in knowledge level of farmers before and after imparting training and demonstration; Table 7 revealed that Upper Jumi had highest percentage change with1400% on fish species selection followed by Mani 1217%, Midpu 1071%, Balapu 1043% and Chiputa 844%. Fish species ratio combination percentage change was highest in Upper Jumi and Mani with 550%,

Table 7. Knowledge of farmers on CFC percentage change

Sr. No.	Parameters	Knowledge of farmers on CFC percentage change																	
		Midpu			Mani			Chiputa			Balapu			Emchi			Upper Jumi		
		L%	M%	H%	L%	M%	H%	L%	M%	H%	L%	M%	H%	L%	M%	H%	L%	M%	H%
1	Fish species selection	90	17	1071	88	21	1217	92	25	844	89	10	1043	84	38	567	87	40	1400
2	Fish species ratio combination	74	282	350	76	242	550	78	233	425	78	378	533	76	344	242	75	300	550
3	Fish seed stocking stages (fry and fingerling)	92	86	1014	90	89	971	88	30	756	92	117	1500	88	0	508	88	83	1850
4	Fry/fingerling treatment (NaCl)	82	500	1100	86	660	1533	83	400	1150	83	3600	4500	84	400	750	81	1167	4300
5	Fish stocking density	84	38	600	87	58	689	81	18	800	86	90	2200	91	100	462	88	162	1600
6	Pre and post-stocking management	81	175	786	83	186	983	78	82	933	88	800	7000	88	213	364	79	600	5800

NB.1. Percentage (%) change in negative for Low and Medium category knowledge was ignored and considered as positive change by keeping the same change in numerical as such, i.e (-90 is considered as +90), since knowledge of farmers were shifting to higher category, indicating positive effect of training
2. Rationalization of value after decimal i.e 0.5 and above was round up as 1 and below 0.5 was round up as 0 for better presentation

Table 8. Change in fish yield

Sr. No.	Village	Before Training/demo (Tone/ha)	After Training/demo (Tone/ha)	% change in production(Tone/ha)	EG
1	Midpu	0.76	1.42	86.84	0.66
2	Mani	0.81	1.71	111.11	0.90
3	Chiputa	0.75	1.53	104.00	0.78
4	Balapu	0.84	1.75	108.33	0.91
5	Emchi	0.72	1.44	100.00	0.72
6	Upper Jhumi	0.79	1.39	75.95	0.60
	Avg.	0.78	1.54	97.43	0.76

**EG= extension gap*

followed by Balapu 533%, Midpu 350%, Chiputa 425% and Emchi 242%. Fish seed stocking stages (fry and fingerling) percentage change was highest in Upper Jumi 1850% followed by Balapu 1500%, Midpu 1014%, Mani 971%, Chiputa 756% and Emchi 508%. Fry/fingerling treatment (NaCl) percentage change was highest in Balapu 4500% followed Upper Jumi 4300%, Mani 1533%, Chiputa 1150%, Midpu 1100% and Emchi 750%. Fish stocking density percentage change was highest in Balapu 2200%, followed by Upper Jumi 1600%, Chiputa 800%, Mani 689%, Midpu 600% and Emchi 462%. Pre- and post-stocking management percentage change was highest in Balapu 7000%, followed by Upper Jumi 5800%, Mani 983%, Chiputa 933%, Midpu 786% and Emchi 364%.

It is seen that highest change in knowledge level on all the undertaken six parameters on CFC was highest in farmers of Upper Jumi and Balapu village, although there was highly significant changes in knowledge of farmers of other villages also. The highest percentages change in the mentioned above two villages may be due to personal interest of farmers to know more about CFC, as these two villages were remotely located away from state capital and district headquarter (Fig.1).

4. CONCLUSION

Training and demonstration to farmers on CFC is very important because with similar efforts and energy expended in producing fish without knowledge of package of practices on CFC recorded very low yield, as compare to fish yield per hectare of pond with technical knowhow on CFC. Therefore, not only in CFC training and demonstrations is necessary for better yield, such kind of programme is equally important in other aspect of fish productions as well.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Authors hereby declare that No generative AI technologies such as large language models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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