*Indian J. Fish., 67(2): 102-109, 2020*
DOI: 10.21077/ijf.2019.67.2.79563-14

# Institutional perspective for doubling fish farmers' income: A case study

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## ABSTRACT

Doubling farmers' income (DFI) by 2022 has been set as a target for Agriculture sector of India. Extensive deliberations have been made on application and adoption of technologies/packages as key forces to reach the target. The responsibility is with numerous stakeholders and the specific role of Research and Development (R&D) institutions in doubling farmers' income has not been touched upon. As agriculture and allied sectors like aquaculture is a state subject, greater linkages have to be established by R&D institutions to achieve the target. The present study analysed the role of R&D institution in doubling farmers' income, keeping technology as an effective tool, based on a case study of ICAR-Central Institute of Freshwater Aquaculture (ICAR-CIFA), Bhubaneswar and Krishi Vigyan Kendra (KVK)-Khordha in Odisha State, India. The results of the study delineated the ways and means for ICAR-CIFA and KVK, Khordha to achieve the target of doubling farmers' income by developing models with existing proven technology, upscaling proven extension approaches like Farmers Field Schools (FFS) replicated as Aquaculture Field Schools (AFS), best practices to be adopted and rationalising farm innovations.

Keywords: Doubling farmers' income, Production, Institutions, Technology

## Introduction

After long debates all over the country, now the Government of India (GoI) has a seven point strategy to double farmers' income involving technology dissemination to infrastructure development. Doubling farmers' income (DFI) by 2022 has been kept as a target in Indian Agriculture and scientific deliberations on this subject have been widely witnessed from the related stakeholders of the sector. Chand (2017) argues that the earlier strategies towards increasing production and securing food security have not touched upon increasing the income of farmers. The average monthly income per agricultural household from various sources is estimated to be ₹6,426, according to the survey done by the National Sample Survey Office in 2013 (Anon., 2017). Average income of a farmer household was estimated at ₹96,703 in 2015-16; which is supposed to rise to ₹2,19,724 (at current prices) by 2022-23 through government interventions (Anon., 2017). Govt. of India has set an ambitious goal to double farmers' income by 2022 and the range of strategies planned as investing in irrigation to crop insurance. But if the food value chain is to undergo true transformation, it needs to move from a production-driven system to one driven by demand, one that increasingly connects consumers with producers (Bora, 2016).

The application and adoption of technologies/ packages as key forces to double the farmers' income has been debated in deliberations and high level policy dialogues. It is a general opinion that though there are farmers who have tripled their income, this is not being replicated by many. The government, non-government as well as private R&D (Research and Development) institutions; academic institutions; extension agencies; development missions on watershed, organic farming and many others; farmer organisations and financial institutions need to play important roles to achieve the target. Chand (2017) outlined the role of institutions (farmer producer organisations, farmers' collective actions) and support agencies for doubling farmers' income. Bora (2016) discussed about the process of doubling farmers' income through more investment, more on-the-ground resources, new collaboration models that combine the knowledge and resources of diverse stakeholders and which share best practices, risks and mutual accountability.

The Ministry of Agriculture and Farmers' Welfare, Govt. of India has put forth a plan for 100 research institutes functioning under the Indian Council of

Agricultural Research (ICAR), New Delhi to develop economically feasible models to help farmers double their income (PTI, 2017). The present actors who can be called enablers to double the farmers' income are presented in Fig. 1. From Fig. 1, it is clear that the end products of R&D institutions are vital for other actors to play a better role. More than the technology generation, there is ample scope for R&D institutions to work on developing models to scale up proven technologies, sharing information and knowledge through the database created and thereby can strongly influence policy options. As clear from Layer 1 (Fig. 1), the government is meant for evolving policy at central and state levels. Layer 2 depicts the institutions that play a major role especially the R&D and the state extension agencies in agricultural development. In Layer 1, there are two enablers *viz*., private and farmer based institutions which are independent in nature, however they are governed by the policies of either central or state government. Layer 3 shows the outcomes that can be mutually used by each actor to converge and bring change. Much water has not flown to argue and conclude the role of institutions (R&D, semi extension agencies and extension agencies) which are key in this process and we need to remember that agriculture and allied sector development is a state subject. With this in view, this paper analyses the role of institutions on doubling farmers' income, keeping technology as an effective tool, based on a case study of Krishi Vigyan Kendra, (KVK), Khordha and ICAR-Central Institute of Freshwater Aquaculture (ICAR_CIFA), Bhubaneswar, Odisha, India.

## Materials and methods

A rapid reconnaissance study was carried out towards analysing the doubling farmers' income concept proposed by the Government of India in an institutional perspective. ICAR-CIFA, an R&D institution on aquaculture and its farm science centre KVK located in Khordha District, Odisha working on agriculture and allied sectors were purposively selected. The justification for selection of ICAR-CIFA and KVK, Khordha for this study was mainly owing to many research and development interventions envisaged by these institutions in the aquaculture sector. Since, the government pronounced doubling farmers' income, ICAR-CIFA and KVK, Khordha have been

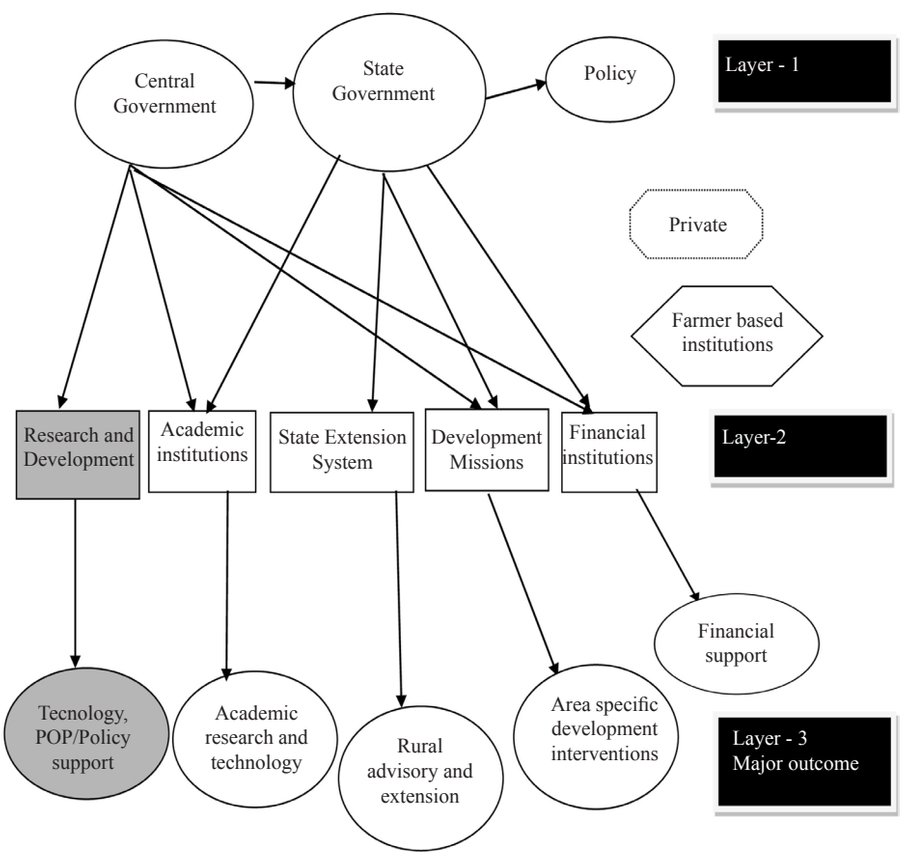


Fig. 1. Positioning R&D institutions in doubling farmers' income

providing critical inputs towards the strategies with special reference to aquaculture. Khordha District in the state of Odisha, is endowed with abundant natural resources providing different livelihood options for rural and urban communities. Both primary and secondary data were collected for analyses. Selected cases of developmental interventions of KVK were studied to provide primary inferences in line with the objectives of the study. Above all, the study also documented the process and series of activities undertaken by ICAR-CIFA and KVK to achieve the target of doubling farmers' income. The framework for the study also took roots from the Agricultural Knowledge and Innovations System (AKIS).

## Results and discussion

*Role of R&D institutions in seven point strategy devised by the government for doubling farmers' income*

Several institutions have been established to perform certain activities to trigger development in every sector. All institutions are meant to carryout activities that at the end serve the public in terms of changing lives with better socio-economic status. Orders of governments in certain situations calls for holistic development and institutions have to perform beyond activities set. In this study, we have analysed the roles played by institutions in doubling farmers' income.

Government of India formulated a seven point strategy for doubling farmers' income which ranges from expanding the irrigated area to diversification including the secondary agriculture. These pillars are expected to be the enablers to achieve the targets. Most of the pillars of DFI are related to a sector of concern and role of R&D institutions are basically into mapping out best practices and technology delivery. Out of the seven pillars, in case of only three pillars (Pillars 1, 2, 7), R&D institutions have an active role to play (Table 1). In case of the remaining four pillars, the role is very much meagre which is concerned with infrastructure and policy level initiatives (Pillars 3, 4, 5, 6). Above all, even with the three pillars where R&D has an active role to play, it is evident that without state actors, the target cannot be accomplished. Support to extension system at state level is mandatory to achieve the target, as agriculture and allied sectors are state subjects.

*Information and knowledge - A repository*

Information and knowledge on scientific practices will help to improve the farm income. Adoption of innovations are linked with information and knowledge. The core areas that R&D institutions work largely revolves on basic and applied research and a few action research projects. The outcomes of these activities are products in terms of innovations evolved into package of practices (POP) and models that can be replicated in different agro-climatic zones. Information, knowledge and skill generated out of these activities are reflected and transferred to state actors for possible promotion, as agriculture and allied sector development is always a state subject. Adhiguru (2009) studied the information flow and sources of information in the fisheries sector and concluded that most farmers sought information on 'management and marketing' (8-46%) and 'seed production' (2-27 %). For seed production, a large number of farmers contacted the extension workers (27%) and input dealers (27%), probably because these sources, apart from providing information, also supplied fingerlings. Usually, wherever information was supplemented with inputs, farmers preferred those sources to save search and acquisition costs on information from other sources. Kumaran *et al.* (2012) reported that 90% of brackishwater aqua farmers depend on private extension sources for information. Information seeking by the extension personnel was less

Table 1. Role of R&D institutions in enabling doubling farmers' income

| Pillars | Focus/activity | Role of R&D and intensity of the role |
|---|---|---|
| 1 | Focus on irrigation resource building | Resource mapping and technology (Active role) |
| 2 | Increase production through improved seeds, planting materials, organic farming and soil health card | Technology for quality seeds (Active role) |
| 3 | Strengthening of warehouse and cold chain facilities to curb post-harvest losses | Identification of locale for creating such facilities (Meagre role) |
| 4 | Value addition through food processing | Technology (Meagrr role) |
| 5 | Overcoming agriculture marketing deficiencies through e-National Agricultural Marketing (e-NAM) | Identification of issues on marketing (Meagre role) |
| 6 | Work on institutional loan to reduce risk and growth of agriculture sector | Mapping out Institutional innovations (Meagre role) |
| 7 | Allied activities like dairy development, poultry, beekeeping, fisheries, agro-forestry and Integrated Farming System | Technology (Active role) |

than 50% and less than 50% of the researchers expressed having had consultations with the extension agencies. It has been observed that farmers who use information from extension services have 80% higher net income (NABARD, 2016). However, it is also the responsibility of R&D institutions to rationalise farmers' innovation. Three way communication *i.e*., R&D-farm innovator-state actors for scaling up is another task that will be crucial.

*Bridging the yield gaps*

Varietal improvement alone cannot make a difference in yield and productivity, the most important will be adoption of Package of Practices (POP). Agro-climatic zone specific POP developed by R&D institutions have to make possible taking into consideration of the availability and access to timely inputs. Institutions play a major role in bridging yield gaps through development of POP that are location specific. The issue is about the yield gap from on-station trial and farmers' yield. Information on yield gaps can largely influence development interventions. Much study has not been carried out in aquaculture on yield gaps. Katiha (2005) reported that in inland aquaculture, the yield from on-station research is 8 t $ha^{-1}$, on-farm trials is 5.5 t $ha^{-1}$ and farmers' yield is 2.9 t $ha^{-1}$ The all India yield gaps of aquaculture production from tanks and ponds are to be bridged for better production (Table 2). The prime requirement for improving fish production from the tanks and ponds will be on providing quality fingerlings and a minimum size of 250 g. The question is what will be the role of institutions in this case if taken both by R&D and state extension machinery. However, there are some states where fish yield from tanks and ponds are more than the national average. The reasons being a strong technology base coupled with policy options and robust schemes. A classic example has been witnessed in the state of Chhattisgarh (Bhendarkar *et al*., 2017). From the Table 2, it could be inferred that the highest yield gap is from north-east, western and central regions of India. It is evident that the reason for such high yield gaps in the above regions should be a concern for the R&D institutions with defined strategies. Bridging these gaps are the targets that institutions have to look upon.

*Product value chain and partnerships*

Value addition is one of the key strategies of the government in doubling farmers' income. This issue has been much discussed in the past, however institutions have to work on delivering technologies based on the resources available and extension system has to devise methods to develop packages to increase farm income. In developing a product value chain, one need to understand that each single actor cannot achieve this. The value chain for each product is also a missing link especially with respect to infrastructure like warehousing and marketing. It has been noted that since this target has been fixed, some of the states such as Andhra Pradesh, Karnataka and Maharashtra have developed such partnership platforms, especially integrated value chain projects. Supported by the World Economic Forum's new vision for agriculture initiative, these state-level projects bring together government, private sector, farmer organisations and civil society to jointly develop solutions for integrated value chain projects that will provide farmers with more and better opportunities. R&D institutions have to play a major role in designing such partnerships to be in platforms for the state government supporting with technological backstopping (Bora, 2016). Institutions also have the responsibility to design innovative direct marketing approaches like *Apni Mandi* in Punjab, *Ulavar Santhai* in Tamil Nadu and *Vegetable and Fruit Promotion Council* of Kerala. Ultimately R&D institutions with scientific inputs from social science will play a major role. Models of scaling up technologies have to be grasped and evolve examples for replication.

*ICAR-CIFA and KVK in doubling farmers' income*

Though the extension initiatives of ICAR have played important roles to make transformations in Indian agriculture, their capacity and reach has always been limited compared to those of first-line extension systems run by State-level departments of agriculture (Sajesh, 2016). A platform to connect research and extension is a challenge at different levels (district, state and national). Ananth *et al*. (2018) through an empirical study concluded that research-extension linkage at the lowest level of

Table 2. Yield gaps in Aquaculture

| Region | Yield (t $ha^{-1}$) | Area of ponds and tanks (million ha) | Share of ponds and tanks (in terms of area, %) | Yield gap (t $ha^{-1}$) |
|---|---|---|---|---|
| Central | 1.84 | 0.15 | 6.25 | 4.16 |
| Eastern | 3.28 | 0.52 | 21.25 | 2.72 |
| North-Eastern | 1.25 | 0.35 | 14.31 | 4.75 |
| Northern | 3.13 | 0.20 | 8.08 | 2.87 |
| Southern | 2.62 | 0.90 | 36.83 | 3.38 |
| Western | 1.28 | 0.32 | 13.28 | 4.72 |
| All India | 2.67 | 2.43 | 100.00 | 3.33 |

(Source: Barik, 2016)

district has no concrete framework and extension is loosely organised.

Possession of units by ICAR-CIFA like the social science section (Extension and Socio-Economic Research), Agri Business Incubation Centre, KVK (Extending support to farmers by technology assessment, refinement and demonstration) and other developmental projects (Tribal Sub Plan, NorthEast, Farmers First), *Mera Goan Mera Gourav* and implementation of *Sansaad Adarsh Gram Yojana,* in hand will be the key. These are some of the development projects of ICAR-CIFA that connects directly with farmers. Within a pluralistic extension system, ICAR-CIFA should strive to bring change with the mandated outputs to create an impact. Recently an initiative of ICAR-CIFA is on the appointment of a scientist responsible for all states in India to interact, keep abreast of the industry and have strong interactions for development. Above all, the institute has constant touch with states to train extension workers and provide policy support. Still a rigid and concrete mechanism of linking R&D to state extension is long due.

*Capacity building of stakeholders*

Though ICAR-CIFA is a R&D institution, emphasis has also been given to capacity building activities over the period of time. The institution has regular and tailor made training programmes targeting farmers/farm women, rural youth and extension workers. Capacity building is not a ladder of opportunity but is also an investment on future. Information pertaining to the training programmes conducted by ICAR-CIFA is presented in Table 3.

Table 3. National and international capacity building programmes of ICAR-CIFA (2012-17)

| Year | National | | International | |
|---|---|---|---|---|
| | No. of programmes | No. of participants | No. of programmes | No. of participants |
| 2012-13 | 29 | 999 | 3 | 67 |
| 2013-14 | 20 | 597 | - | - |
| 2014-15 | 20 | 334 | 1 | 2 |
| 2015-16 | 27 | 573 | 2 | 12 |
| 2016-17 | 38 | 875 | 1 | 1 |
| Total | 134 | 3378 | 7 | 82 |

The institute on an average organises 27 training programmes every year benefitting 675 farmers. Above this, the institute also organises international training programmes sponsored by donor agencies. This process of capacity building will gradually accelerated in the coming years to achieve the target of doubling farmers' income. The KVK of ICAR-CIFA, mandated to work on technology transfer, refinement and demonstration also trains practicing farmers/farm women, rural youth and extension functionaries, however confined to Khordha District in Odisha. The KVK attached with ICAR-CIFA, also cater to other district farmers of Odisha especially on pond based integrated farming system and other themes. Information on on-farm trials, front line demonstrations and trainings organised by KVK during 2012-2017 is presented in Table 4.

Significantly, KVK worked with the state employment mission since 2012 to develop 143 aquaculture entrepreneurs through a month long skill development in freshwater aquaculture. Many other similar attempts have been made by KVK to work on skill development for farmers. These activities will also be enhanced to achieve the targets envisaged to double the farmers' income.

*Envisaged plan to achieve the target of DFI*

ICAR-CIFA and KVK-Khordha functioning under the administrative control of ICAR-CIFA target to double farmers' income through development of technological package of practices. The standardisation of package of practices in aquaculture needs to be done for helping the state extension machinery to advice farmers and bridge the yield gaps. Variations in recommendations by each extension worker to the farmer will surely affect the yield due to lack of awareness on technological recommendations. However, one should note that there are cases of farmers whose incomes have been tripled and more, but these are in small numbers, the reason being lack of documentation on successful interventions and larger impacts. As an evident example, farmers adopting pond based integrated farming system have reaped benefits and even doubled their farm income with a net income from

Table 4. Mandatory activities of KVK-Khordha (under ICAR-CIFA targeting end users

| Activity | 2012-2017 | |
|---|---|---|
| | Number | Beneficiary |
| On farm trial | 88 | 761 |
| Front line demonstration | 110 | 2302 |
| Training (on and off campus) | 269 | 5739 |
| Sponsored training | 91 | 2746 |
| Total | 558 | 11,578 |

1 to 3 lakhs from 1.32 acres and in the case of hatcheries there has been proven cases of doubling income (Ananth *et al.,* 2015). The hatcheries have been one of the most profitable enterprises in freshwater aquaculture. In the case study presented, it can be observed that there has been an increase of 40.90% in spawn production and 50% rise in the production cycles. This directly implies in the increase in income of farmers owning hatcheries. The increase could also be attributed to demand as well as off season fish seed production by the hatcheries (Table 5, 6). This will be one of the key areas that ICAR-CIFA and KVK will look forward to reach the target of DFI. Some of the farmers who have doubled/tripled the farm income using technological backstopping from institutions are mostly farmers adopting integrated farming system in the form of enterprise, integrating resources, innovative farming techniques and community based initiatives. There are several successful case studies on farmers adopting integrated farming system who have doubled their farm income by integrating resources that are compatable (Table 7 and 8) . It is evident from the Table 8 that the farmers who adopted integrated farming system have doubled their farm income. It can be inferred that aquaculture combined with horticulture crops has contributed largely towards doubling the income. Farmers who have adopted aquaculture have increased their income by more than 80%.

In ICAR-CIFA, the new approach for doubling farmers' income will be towards developing models with existing proven technology, upscaling proven extension approaches like Farmers Field Schools replicated as Aquaculture Field Schools (AFS), best practices adopted, rationalising farm innovations and scaling up (Fig. 2). As an example, Tisya Aquaculture Field School a unit of Tisya Agri Aqua venture is an initiative to train the farmers/ SHGs/entrepreneurs/aquapreneurs/students to practice pearl and ornamental fish culture. The unit is supported by Agri Business Incubation Centre of ICAR-CIFA. Samantray *et al*. (2019) studied the outcomes of an AFS established by ICAR-CIFA and reported that about 800 fish farmers benefitted from the training programme through AFS. Among them four have adopted portable FRP fish

Table 5. Case of carp hatcheries: A case of five hatcheries developed by KVK-Khordha, ICAR-CIFA

| Name of enterprise | Technological intervention | Unit of productivity | Productivity before intervention (2011-12) | Productivity after intervention (2016-17) | % increase in productivity |
|---|---|---|---|---|---|
| Fish hatchery for seed production | Improved hatchery system (Chinese hatchery) | Spawn (crores) | 4.4 | 6.2 | 40.91 |
| | | Fry (lakhs) | 19.8 | 26.40 | 33.33 |
| | | Fingerling (kg) | 410 | 520 | 26.83 |
| | | Yearlings (kg) | 1620 | 2220 | 37.04 |
| | | Cycles/year | 8 | 12 | 50 |

Table 6. Net income of the hatcheries before and after intervention of KVK-Khordha, ICAR-CIFA

| Source | Net income before intervention (2011-12) | Net income after intervention (2016-17) | % of increase in net income |
|---|---|---|---|
| Spawn | 132156 | 309080 | 133.87 |
| Fry | 237612 | 527045 | 121.80 |
| Fingerling | 61575 | 104000 | 68.89 |
| Yearlings | 162055 | 333010 | 105.49 |
| Total | 593398 | 1273135 | 114.54 |

Table 7. Yield from integrated enterprises

| Enterprise | Yield | | |
|---|---|---|---|
| | 2014-15 | 2015-16 | 2016-17 |
| Horticulture crops | | | |
| Coconuts palm (Nos. per plant) | 80 | 75 | 83 |
| Banana (Bunch per plant in kg) | 15 | 16.5 | 16 |
| Papaya (kg per plant) | 18 | 22 | 20 |
| Livestock | | | |
| Milk (Iiter per cow per day) | 8 | 8 | 8 |
| Meat (kg per animal) | 1.8 | 1.8 | 1.8 |
| Egg (per bird per year) | 140-150 | 140-150 | 140-150 |
| Other (Honey bees per box) | 5 kg | 7 kg | 10 kg |
| Fisheries | | | |
| Fingerlings per acre | 2,40,000 | 2,80,000 | 3,15,000 |
| Any other | Nil | | |

Table 8. Integration of suitable enterprise and increase in net income

| Enterprise | Net income | | | % of increase in net income |
|---|---|---|---|---|
| | 2014-15 | 2015-16 | 2016-17 | |
| Horticulture crops (₹ $ha^{-1}$) | 35000 | 42000 | 50000 | 42.85 |
| Livestock (₹ $yr^{-1}$) | 92000 | 95000 | 112000 | 21.73 |
| Fisheries (₹ $ha^{-1}$) | 192092 | 252000 | 350165 | 82.29 |
| Honey bee (₹ per box) | 2800 | 3500 | 5000 | 78.57 |

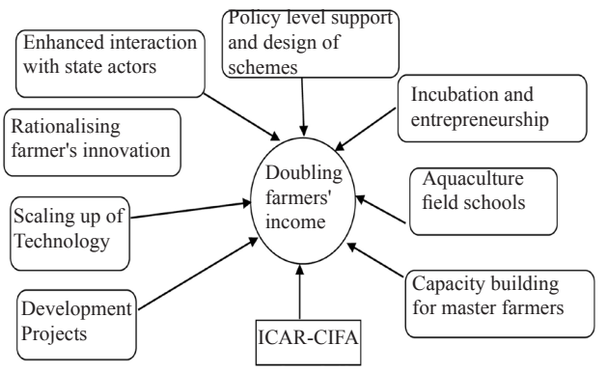


Fig. 2. Schematic representation of the envisaged plan of ICAR-CIFA to double farmers' income

hatchery (Echo hatchery), 200-250 farmers adopted fish farming in own pond as well as in community ponds and 70-80 farmers have entered into the profitable enterprise of fish seed rearing. Scaling up of AFSs for entrepreneurs is an envisaged model that ICAR-CIFA looks upon in the future to achieve the target of DFI.

Use of technology can be game changer in the process of DFI, but institutions are key players and they need to cater in different ways. Reviewing the strategies adopted by R&D institution like ICAR-CIFA in doubling farmers' income, has clearly indicated that it is in line with the expected outcome. An inclusive approach to double farmers' income with strategies like delivering technologies to bridge yield gaps, creating a knowledge economy through enhancing human capital, strengthening the capacity building initiatives through skill development are some of the realistic ways to double the income of farmers.

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Date of Receipt : 09.05.2018
Date of Acceptance : 18.06.2020