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Integrated Approach for Engaging Farming Community - Opportunities and Challenges for Low Cost Inputs

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Abstract – **Agriculture productivity depends on several factor(s) of which tailor-made technological options are paramount for aiding these farming systems. Availability of labour, highly escalated cost of inputs, seasonal challenges, poor networking skills in seeking scientific options, physically demanding farming activities and time availability to seek alternative technologies pose distinct challenge for farmers. Educated youth desire to take agriculture as a diversified means of income, but find it difficult to engage themselves. These challenges need to be evaluated and addressed for generating decent source of income through farming activities. Lack of appropriate technologies to meet their location specific demand has been felt as an important aspect for enhancing farming productivity. In this context, it was felt necessary to demonstrate alternative technologies for complementing established farming practices. It was also equally important to share effective approach to engage farming community considering dynamics of this sector. Participatory meetings in two villages and case studies on farming technologies were conducted. The demand for portable weeders for their agricultural field and ectoparasite medication in treatment of their livestock were met. The approach for locating needy farmers, establishing need for location specific low cost technologies, utilization of natural resources and involving creative solutions developed by grassroots innovators were illustrated in this study. This model of engaging farming community may be practiced for sharing and scaling up of low cost, locally available (LCLA) technologies in minimizing cost of inputs and maximizing farming income through environment friendly solutions.**

Keywords – **Agriculture, Ectoparasite, Grassroot's Innovation, Weed.**

I. INTRODUCTION

Agriculture is an important means of sustenance for majority population in India (Kushwaha, 2008) [14].It was well recognized that more food needs to be produced to meet increasing demand of population, but impact of soil nutrient replenishment through N inputs were cause of concern (Snyder et al., 2014) [21]. The enhanced rural population limits the intensification of crop production, as there were decline in farm income per hectare (Josephson et al., 2014) [11]. Further, in smallholder agriculture system yield gaps were challenges due to inputs such as fertiliser, labor (Tittonell and Giller, 2013) [26]. The unseasonal rainfall causing draught situation has been another major challenge in sustaining agriculture as an income generating activity (Udmale et al., 2014) [27].The change in socioeconomic conditions had direct bearing on the aspiration of farming communities. Hence, identifying appropriate technologies for smallholder agriculture system has been a great challenge for different stakeholders.

Agricultural intensification:

Adoption of agricultural technologies depends on availability of information among farmers and in their neighbourhood (Wollni and Andersson 2014) [30]. It has to be emphasized that various on-farm research had shown success of low cost and low technology tools for small farms in developing countries (Mondal and Basu 2009) [15]. Development and adoption of suitable technologies particularly farm machinery have to be strengthened for agricultural intensification (Bhan and Behera, 2014) [4]. It was also opinioned that successful technologies used by farmers needs to be scaled up (Bellotti and Rochecouste, 2014) [3]. In India, these technologies need to cater to small holder production system. Rawal (2008) referred that a total of 48.79 percent of farm household in the country possess less than 1 hectare of land and about 31.72 percent of population did not possess land (Rawal, 2008) [19].

Problem of weeding due to variable soil and cropping pattern:

Agriculture productivity is affected by weeds in cultivatable land, mostly small scale farmers use chemical or manual weeding. However, these are physically challenging, labour intensive process that act as constraint for crop production. Various portable weeders, power tillers were in practice, but exhibited difficulties such as less versatile, difference in efficiency under variable soil conditions (Gavali and Kulkarni, 2014) [8]. It was also noticed that according crops, the economic impact of weed varies, particularly in cotton it causes loss ranges from 40 to 75 percent (Veerangouda et al., 2010) [28]. These weeds compete for water and hence yield losses in dry land cropping system used to be higher (Kankal, 2014) [12].

Livestock productivity and ectoparasite infestation:

In smallholder's livestock production system, livestock owners had difficulties in sustaining productivity of animals due to ectoparasitic infestation (Rahman et al., 2012) [18]. These infestations not only cause damage to skin, welfare of animals but also transmit diseases (Oliveira et al., 2011) [17]. Many chemical acaricides are used in different regions, however resistance, reoccurrence and environmental concern necessitates search for alternative medications. Further, livestock owners require these medications available at reduced cost for economic

production of milk and welfare of animals. These parasites cannot be permanently controlled and needs to be managed at specific location with insecticides (Wall, 2007) [29].

Various approaches towards intensification of farming activities

Multiple knowledge of farmers and technological frame of reference between farmers and non-farm agents have to be recognized for development of agriculture (Moore et al., 2014) [16].Government policies need to address to increase agriculture labour productivity (Dorward, 2013) [5]. Further, the goal of most public policy is for women's economic and social advancement (Sraboni et al., 2014) [22]. These low cost technologies involving less input cost and technical solutions, may come as needful for women members of the farming community. These may be viable options in promoting small scale medium enterprises along with nurturing of human resource (Kurniawati and Yuliando, 2015) [13].

II. METHODOLOGIES

Aresearch study was conducted in twovillagesviz., Amrapur and Ambod of Mansa Taluk, Gandhinagar district, Gujarat, India. These villages were purposively selected to understand the nature of problems faced by farmers in enhancing agricultural productivityas well as demonstrate suitable technologies in their premises. Several personnel meetings, public announcement were conducted for sensitizing farmers and to enable participatory group meeting in their locale. Village group meeting was held among nineteen villagers in their preferred timingsduring the study period.The collected data were systematically recorded and analysed according to the objectives of the study. The suitable statistical tools like mean, standard deviation and student *t* test were used to explain the nature of variables influencing the utilization of low cost locally available practices. Further, in the present study, individual case studies were also conducted through observation and personnel interview. The conducted individual case studies had enhanced the understanding of the research study through sharing new insights. These studies were carried out for inferring the role of integrated approach in solving farming communities' immediate problems.

III. RESULT AND DISCUSSION

A. Group meetings at villager's premises for understanding challenges of farming community:

About 42.10 per cent of the participants of group meeting in the study locale had desire to use an alternative technology. During group meeting it was evaluated to understand the relation between size of land and requirement of weeder. It was found that a non-significant association was established between two variables at the study locale. The table value of $t_{17,\ 0.05}$ was found to be 2.11 and calculated t value [$t_{17,0.05}$=0.18] was less than *t* table value at same degree of freedom (Table 1). It was felt that small area of weed zone had to be removed by bringing large tractor weeder particularly during rainy season. This raises input cost to farmers and they need to depend on external support for removing weed infestation. Farmers need to invest time and forgo their convenience while seeking such skilled support.

Table 1: Association of size of land and weeder*

SN	Farmers desire to use		Farmers did not desire to use	
	Size of land (in Bigha**)	$(x_1- \bar{x}_1)^2$	Size of land (in Bigha**)	$(x_2- \bar{x}_2)^2$
1	3	9	7	2.10
2	4	4	1	20.70
3	5	1	0	30.80
4	8	4	5	0.30
5	8	4	5	0.30
6	10	16	3	6.50
7	2	16	25	378.30
8	8	4	5	0.30
9	-	-	2	12.60
10	-	-	3	6.50
11	-	-	5	0.30
	Mean ($\bar{x}_1$): 6	Sum $\sum(x_1- \bar{x}_1)^2$: 58	Mean ($\bar{x}_2$): 5.55	Sum$\sum(x_2- \bar{x}_2)^2$: 458.73

* Non significant as $t_{17,\ 0.05}$ table value = 2.11; calculated t value $t_{17,0.05}$=0.18
** Equal to 0.16 hectare

Farmers in the study area were approached through dairy society and a group meeting was organized. The mean age group of respondents was found to be 50 years of age (50.37$\bar{x}$ ± 11.48α) and most of them had on an average 5.74 Bigha land (5.74$\bar{x}$ ±5.36α) for agriculture activity. One of the respondent did not have land, referring that these village meetings enable respondents of different nature to participate and to share their difficulties. During the meeting, majority of them had illustrated that raising input cost and diseases of crop, livestock as impediment factors affecting agriculture produce. Farmers were oriented with availability of low cost locally available

(LCLA) alternative technologies and sought their opinion to such technologies. These creative technologies were developed by grassroots innovators in similar rural environment. This had commanded adequate response among farmers for implementing LCLAin their village.

B. Case study: Need for tillage operations:

Baig et al., (2013) [2] indicated that weed infestation as one of the constraint faced in rain-fed agriculture system. Farmers in most part of the country face labor shortage and found the method of cultivation using cattle and hiring tractor a costly proposition. The acute shortage of human resource to undertake timely weeding affects the standing crops adversely. It is very difficult for the marginal farmers to buy tractors for doing farming operations in their field. Hoeing and weeding is generally done manually in most of marginal farms. Tractor operated weeding implements can save time and cost but leave the headland uncovered if the farm size is small. The compaction of the soil by tractor reduces porosity.

Manually operated weeders generally have low work rate and lead to significant losses during acute shortage of labour. A number of designs of engine operated weedersis available in art and market having C or L type blade profiles (Tajuddin et al, 1991 [24]; Tajuddin, 2006 [25]). Studies done by Hendrick (1980) [10] and Araya and Wu (1987) [1] revealed that rotory powered active tillage machine needs less than 50 % specific energy as compared to passive tillage tool. However, it was also noticed that the forward rotating powered rotor provided its own thrust through the soils and returned a proportion of its power demand to the system as negative thrust. This negative thrust results difficulty in manoeuvrability of the machine in the field. The sweep type weeders are alternative solution of engine operated rotary weeders. Engine operated weeders with rotary blades also do excessive digging of soil if not handled properly.

Studies by Srinivas et al (2010) [23] has revealed that weeding efficiency of sweep type engine operated weeder is comparatively less than C and L shaped rotary weeders. However the cost of operation is less than C shaped weeder. Time required for weeding with C and L type blades is always higher than sweep type blade as, rotary tillers needs 2-3 passes between crop rows to completely cover the weed infected areas. Further, when depth of cut is preferred than inversion, sweep type blade is preferred.

(i) Creative solutions developed by grassroots innovator for farming community challenges:

MahipalcharyKadivendi, a creative farmer from Andhra Pradesh had developed a solution for weeding and other tillage operations at lesser cost and faster work rate in small holder farming units. It is a self-propelled cultivator having passive tillage tool (reversible shovel type with tynes). The operator needs to walk behind the machine. It comprises 4 hp/ 5 hp engine, power transmission system including chain and sprocket, belt and pulley; lugged wheels, toolbar, reversible shovel type tool with tynes, etc. It can be operated up to 6 inches depth in wet land and 4 inches depth in dry land. It has average field capacity 0.4-0.5 acre/h consuming 0.5 lit/h diesel. The grassroot innovator had sold over fifty such weeders in the regions of Waranagal, Karimnagar, Guntur, Nellore, Hyderabad, Kurnool, Khammam and Nalgonda districts of Andhra Pradesh and Telangana. The operational cost of machine was estimated around Rs 200 per acre which was 15-20% of the cost incurred in performing the task manually in conventional ways.

(ii) Demonstration of technology for removing weed by farmers themselves:

A trial was conducted by farmers Shri Rathod Karansingh Baluji and Shri BhathijiThakor for removing weeds in their chilli and cotton field by power operated weeder. Generally, farmers does cropping based on availability of tractor size and not on requirement of cultivation practices. With decreasing land holding size, identification of new means for engaging small holders needs to be developed or scaled up. During their demonstration of this machine at their premises, farmers could able to seek local fabrication units' support for maintenance and need not to depend on skilled enterprises. They had also learned the need to provide operational space for the machine for every one hour so as to reduce heat load. These feedbacks helped in sustaining low cost inputs and make them readily available as per requirement of farmers.

C. Case study for herbal ectoparasite medication:

(i) Need for ectoparasite medication:

Ectoparasites in ruminants cause serious economic loss to small livestock farmers (Gebreselama et al., 2014) [9]. Chemicals insecticides such as organophosphorus, Synthetic pyrethroid and ivermectins are used in India (Singh et al., 2014) [20]. However, application of these chemical insecticides had limitations and faced challenges like resistance, environmental contamination, insecticidal residues in livestock products (Emmanuel, 2014) [6]. The lack of awareness of livestock owners had also contributed to wide prevalence of ticks (Fentahun et al., 2012) [7]. Research studies are being carried out globally to identify alternative environmental friendly medications. Indigenous veterinary medications has been in use among farming communities and trees like neem (*Azadirachtaindica* A Juss) locally called as Limbado and Monks Pepper (*Vitexnegundo* L.) locally called as nagodwereknown for acaricidal properties. A preparation of 6.00 percent polyherbal spray was shared among villagers during the village meeting for control of tick infestation.

(ii) Case history and clinical observations

The livestock farmer Shri. DilipsinghUdhajiChavda in the village Ambod had maintained five animals (two adult cattle, one calf and two adult buffaloes) that were infested with hard ticks. These animals had case history of medication such as Deltamethrin and parenteral administration of conventional medication Ivermectinearlier. However, the reoccurrence of ticks was noticed by farmerin one month duration. All animals were infested with heavy tick infestation at preferential sites like neck, belly, groin and udder regions. The farmer felt constrained to call the resource personnel at different time and faced emotional difficulties upon observing the inflamed skin condition at the injected site on animal. He

had spent atleast Rs.150/- per time for an animal to control tick infestation. However, he had observed the recurrence of ticks within a period of ten days. During the same time, he had topically administered the herbal composition prepared by nearby farmer who had earlier participated in village group meeting. The medication was prepared with help of limbado (neem) and nagod (monks pepper) in specific ratio as indicated earlier. The preparation was practiced in the village and found effective among villagers. Shri Dilipsinghhad sought the preparation developed by other farmers and was convinced to use the herbal medication. The farmer had applied the medication twice a day and found relief of animal from next day onwards. The total control of ticks was noticed in 3 days duration. These animals were clinically examined and found no reoccurrence of ticks after 14 days of poly herbal treatment.

IV. Conclusion

Farmers in most part of the region are looking for integrated solution, the rural development initiatives may succeed if their realistic aspirations are met by stakeholders. New measures to engage the farming community for enhancing productivity and decreasing input costs has been felt. Research institutions and industries are trying different options to meet the demand. However, such technological practices may be derived based on convenience of research or industry system(s). This convenience may be in terms of sustaining demand, supply chain, cost benefit ratio, in-house facilities and human resource. These products made available in turn had to face the uphill task of adoption, maintenance and to meaningfully involve prospective service delivery mechanisms. These features resulted in enhanced input cost to farmers by seeking experts or skilled man power to work in their farm situation. The availability of skilled resource personnel as per need make these tasks more difficult for farmers as they had limited time available during peak seasonal activities. It was also found that small holding system may not able to afford such technological practices owing to their poor resource mobilization.

References

[1] Araya, K.S., and Wu.T.L., 1987.A powered rotary subsoiler with pressurized sewage sludge injection. Transaction of the ASAE 30(5): 1226-1230.

[2] Baig M.B., Shahid S A., and Straquadine G S, 2013. Making rainfed agriculture sustainable through environmental friendly technologies in Pakistan: A review, International Soil and Water Conservation Research, 1(2): 36-52.

[3] Bellotti, B., and Rochecouste, J.F., 2014. The development of Conservation Agriculture in Australia—Farmers as innovators, International Soil and Water Conservation Research, 2(1): 21-34.

[4] Bhan, S., and Behera, U.K., 2014. Conservation agriculture in India – Problems, prospects and policy issues, International Soil and Water Conservation Research, 2(4): 1-12.

[5] Dorward, A., 2013. Agricultural labour productivity, food prices and sustainable development impacts and indicators, Food Policy, 39: 40-50.

[6] Emmanuel, N., 2014. A survey of acaricide use in the control of ectoparasites by livestock farmers in sub urban Accra, Ghana. Agriculture, Forestry and Fisheries, 3(2): 58-61.

[7] Fentahun T., Woldemariam F., Chanie M., and Berhan M., 2012. Prevalence of Ectoparasites on Small Ruminants in and Around Gondar Town, American-Eurasian Journal of Scientific Research 7 (3): 106-111.

[8] Gavali, M., and Kulkarni, S. 2014. Development of rotary weeder blades by Finite element method, International Journal of Scientific research Engineering and Technlogy, 3(6); 941-945.

[9] Gebreselama, M., Zeru, F., and Romha, G., 2014. Identification and prevalence of ectoparasites in cattle and sheep in and around Bishoftu town, central Ethiopia. Animal and Veterinary Sciences, 2(4): 124-129.

[10] Hendrick, J.G., 1980. A powered rotary chisel. Transactions of the ASAE 23(6): 1349-1352.

[11] Josephson A.L., Gilbert J.R., Raymond J.G.M. Florax, 2014. How does population density influence agricultural intensification and productivity? Evidence from Ethiopia, Food Policy, 48: 142-152

[12] Kankal, U. S., Khmabalkar, V.P., Karale, D.S., and Nage, S.M. 2014. Effect of operating speed, moisture content of soil and approach angle of sweep on specific draft and weeding efficiency, The International Journal Of Engineering And Science (IJES), 3 (6): 1-9.

[13] Kurniawati D., and Yuliando, H., 2015.Productivity Improvement of Small Scale Medium Enterprises (SMEs) on Food Products: Case at Yogyakarta Province, Indonesia, Agriculture and Agricultural Science Procedia, 3: 189-194.

[14] Kushwaha N., 2008. Agriculture in India: Land use and sustainability, International Journal of Rural Studies, 15 (1) Pp. 1-10.

[15] Mondal P., and Basu M., 2009.Adoption of precision agriculture technologies in India and in some developing countries: Scope, present status and strategies, Progress in Natural Science, 19 (6): 659-666.

[16] Moore, K M., Lamb, J N., Sikuku, D N., Ashilenje, D.S., Laker-Ojok, R. and Norton, J. 2014. Multiple knowledges for agricultural production: Implications for the development of conservation agriculture in Kenya and Uganda, Journal of Agricultural Education and Extension, 20 (3): 291-307.

[17] Oliveira, J.B.,Montoya, J., Romero, J.J., Urbina, A., Soto-Barrientos, N., Melo,E.S.P., Ramos, C.A.N., and Araújo, F.R. 2011. Epidemiology of bovine anaplasmosis in dairy herds from Costa Rica, Veterinary Parasitology 177: 359–365

[18] Rahman, M. A., Islam, M. A., Rahman, M. A., Talukder, A. K., Parvin M. S. and Islam, M. T., 2012. Clinical diseases of ruminants recorded at the patuakhali science and technology university veterinary clinic, Bangl. J. Vet. Med., 10(1&2): 63-73.

[19] Rawal, V., 2008. Ownership Holdings of Land in Rural India: Putting the Record Straight Economic & Political Weekly, March, 43-47.

[20] Singh, N. K., Randhawa, S. N. S. Jyoti. 2014. Ectoparasite control in dairy animals with special reference to resistance development: An Indian scenario. 2nd International Conference on Animal & Dairy Sciences, 5(3): 79.

[21] Snyder, CS., Davidson, E.A., Smith, P., and Venterea, R T. 2014. Agriculture:sustainable crop and animal production to help mitigate nitrous oxide emissions, Current Opinion in Environmental Sustainability, 9-10:46-54.

[22] Sraboni E., Malapit H.J., Agnes R.,Quisumbing, Akhter U. Ahmed, 2014. Women's Empowerment in Agriculture: What Role for Food Security in Bangladesh? World Development, 61: 11-52.

[23] Srinivas, I., Adake, R.V., Reddy, B. S., Korwar, G. R., Thyagaraj C.R., Dange, A., Veeraprasad, G., and Reddy R. C., 2010. Comparative performance of different power weeders in rainfed sweet sorghum crop. Indian J. dryland Agric. Res. & Dev. 25 (2): 63-67.

[24] Tajuddin A., 2006. Design, development and testing of engine operated weeder. Agricultural Engineering Today, 30(5,6):25-29

[25] Tajuddin A., Karunanidhi, R and Swaminathan, K.R., 1991. Design development and testing of an engine operated blade harrow for weeding. Indian Journal of Agricultural Engineering, 1(2):137-140

[26] Tittonell P., andGiller K.E., 2013.When yield gaps are poverty traps: The paradigm of ecological intensification in African smallholder agriculture, Field Crops Research, 143: 76-90.
[27] Udmale P, Ichikawa Y., Manandhar S., Ishidaira H., and Anthony S., 2014. Kiem Farmers′ perception of drought impacts, local adaptation and administrative mitigation measures in Maharashtra State, India, International Journal of Disaster Risk Reduction, 10, Part A: 250-269.
[28] Veerangouda M., Sushilendra ER., and Anantachar M., 2010. Performance evaluation of weeders in cotton, Karnataka J. Agric. Sci.,23 (5) : 732-736.
[29] Wall, R., 2007. Ectoparasites: Future challenges in a changing world, Veterinary Parasitology 148: 62–74.
[30] Wollni, M., and Andersson, C., 2014. Spatial patterns of organic agriculture adoption: Evidence from Honduras, Ecological Economics, 97: 120-128.

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