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Issues, Challenges and Opportunities of Agriculture in West Kameng District of Arunachal Pradesh

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ABSTRACT

A survey was made during 'Kisan Jawan Vigyan Mela' at Defence Research Laboratory Research and Development Centre (DRL R&D Centre), Salari, West Kameng district of Arunachal Pradesh with an aim of getting insight of issues, challenges and opportunities of agriculture sector. The relevant data was collected during Mela from 67 farmers of 11 villages of the district using semi-structured interview (SSI) and a rank-based quotient (RBQ) was worked out to rank the farmers issues and challenges. Based on ranking of problems by the group of farmers, outbreak of insect-pest and diseases, paucity of quality seed material of field and vegetable crops and lack of technical knowhow were found to be the major issues and challenges of the region. The problem solution trees for three of the major problems were constructed and the opportunities in hill farming were suggested to the farmers as per the impact analysis and RBQ.

INTRODUCTION

West Kameng is one of the districts of the mountainous state of Arunachal Pradesh in North-East India with its headquarters in Bomdila and lies between 91° 302 to 92° 402 East longitude and 26° 542 to 28° 012 North latitude having an area of 2873 sq. km. Defense Research Laboratory (DRL, DRDO), Tezpur (Assam) has a Research and Development Centre (R&D Centre) at Salari village in West Kameng which is located in mid hills at an altitude of 1069 meters at a distance of 30 km from district headquarters. This village is the vegetable basket of West Kameng district as there is year-round production of tomato and cabbage. However, poor productivity and quality issues are major challenges.

The high and medium altitude area of Arunachal Pradesh are least explored with respect to status, challenges and opportunities in farming sector while agriculture is the mainstay of the inhabitants of the region. A very limited number of studies conducted so far necessitates the detailed survey of these areas to identify major issues and challenges and to suggest tangible solutions to farming community. A plethora of problems in production, marketing and storage of crops are faced by the farmers particularly dwelling in forward areas of hilly region. The inadequate supply of inputs, unawareness about the good agricultural practices (GAPs), hovering freight charges, low seed replacement ratio, lack of timely availability of sufficient and good quality seed material, irrigation problem, non-availability of sufficient credit, non- remunerative market price for the farm produce, lack of sufficient storage space and facilities and malpractices exercised by middle man are to name a few (Arneja et at., 2009; Lal et al., 2011; Pandit et al, 2017; Katayani et al., 2017; Reema et al., 2020). Hence, the productivity of this region is sub optimal due to cumulative effect of aforementioned problems coupled with environmental and socio-economic factors. However, it can be significantly enhanced, provided there is proper information about the root causes of problem. Although, there are number of farmers' welfare scheme, which are being implemented by the Government to uplift their socio-economic standards, there is lacuna in outreaching the last beneficiary due to unavailability of the information about ground zero problems and feedback. It is reported in previous studies that there is a knowledge chain between information required by the

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farmers and its source (Mwakaje, 2010). Furthermore, it is found that most of the farming communities of the country do not have access to information related to improved farming practices (Meitei & Devi, 2009). Keeping the above in view, a study was undertaken during DRDO 'Kisan Jawan Vigyan Mela' organized at the DRL R&D Centre in Salari during September 2018 to find out the major issues, challenges and opportunities of agriculture in West Kameng district of Arunachal Pradesh and to rank the problems for their tangible solutions.

METHODOLOGY

A brief survey was made during the DRDO 'Kisan Jawan Vigyan Mela' under the theme of "Technologies for doubling farmers' income". The interview schedule for gathering information was prepared in a bilingual format and were distributed among the farmers during the farmers registration process. The schedule was filled by interview method for the purpose. The major agriculture related problems identified in the 11 villages of district West Kameng listed and Rank Based Quotient (RBQ) of the problems was worked out based on the ranking done by 67 farmers of the villages. RBQ was calculated using following formula as devised by Sabarathnam (1988):

$$RBQ = \frac{\Sigma f_i (n + 1 - i)}{N \times n} \times 100$$

Where, i = Concerned ranks, N = Numbers of farmers, n = Numbers of ranks, fi = Frequency of farmers for i^{th} rank of the technological need

Based on the agriculture-related problems identified, a problem-solution tree was constructed to appropriate the possibilities to overcome the identified problems. A proper understanding on the agricultural practices such as variety of the crops grown in these areas is paramount for tasking the problems of insect-pests and diseases associated with these crops. The fair was conducted to suggest and recommend appropriate package of practices to the farmers for improvement in productivity of their crops. The farmers' feedback was recorded to estimate the possible impact of the suggested interventions. For this purpose, a farmers-scientists interaction session was organized in the form of '*Kisan Gosthi*' in which the farmers actively participated and discussed about their agriculture related problems. The problems were categorized for rank and suggestions of the experts were categorized for the impact analysis. The weightage was calculated in percent and it was depicted accordingly.

RESULTS AND DISCUSSION

Geo-demographical status

Major population of the district is dwelling in rural areas accounting for 82 per cent and economy of the *Monpa* tribes is primarily agrarian (Anonymous, 2011). Terrace farming is common in this region owing to undulated topography with sloppy terrain. Most of the farmers own land holding that falls under the category of small to medium (0.5 hectare to 1.0 hectare) as pointed out during the interaction with farmers. The traditional unit of land measurement in West Kameng is *kattha*, which is approximately 720 square feet. Soil of West Kameng district are mainly coarse in texture, acidic in soil reaction and rich in organic matter, potassium and magnesium but low to medium in sulphur and phosphorus (Sannigrahi and Pandey, 1998). The physical condition of the soil of the region is such that it can support a wide range of crops. The major staple food crop of the region is maize supplemented with local rice, millet, buckwheat, wheat and barley. Soybeans, French beans, chilies, potatoes, cabbage, cauliflower and apples are mainly cultivated for self-use and, to some extent, for the sale in local markets (Singh & Sureja, 2006).

These farmers also grow some miscellaneous crops as per their family requirement like wheat, soybean, vegetable mustard (*lai patta*), leek and some medicinal crops. Salari village and its adjacent region is known for tomato cultivation. It is mainly a vegetable growing belt, which is mainly comprised of tomato and cabbage cultivation. Farmers of locality mainly grow local varieties of crops or they purchase seeds from local seed vendors of Tezpur in Assam. State Horticulture Department, KVKs and DRL R&D Centre Salari are some of the outlets from where some progressive farmers collect quality seeds etc.

Table 1. General agricultural analysis of participant villages of West Kameng District

Particulars	Details
Major Crops	Field crops Maize (kharif), Kidney bean, Mandua (finger millet), buckwheat, wheat (rabi) etc. Vegetable crops Tomato, cabbage, beans, cucumber, chili, pumpkin, chow-chow, radish, capsicum, potato etc. Fruit crops orange, lemon, walnut, apple, pomegranate, mango, kiwi, persimmon, watermelon etc. Spices ginger, garlic, cardamom, turmeric etc.
Cropping pattern	*Jhum* cultivation, patches of permanent pastures and sedentary agriculture
Water resources	Kameng River (lifting) and diversion of water streams
Agro-technologies	Sun drying of wild fruits and cultivated vegetables for lean seasons, terrace farming, bamboo structure for staking of tomato plants, mixed farming of maize with cucurbits etc.
Problems	Undulated topography, sloppy terrain, heavy rainfall and soil erosion, Insect-pest and disease outbreak, Water unavailability during winters due to wastage of water by heavy runoff, Unavailability of quality seed material and manures/ fertilizers.
Opportunities	Integrated insect-pest and disease management (IPM and IDM)Introduction of remunerative crops such as exotic vegetables, strawberry etc. and their soilless nursery under low cost protected structures, Popularization of vermicomposting and mushroom technology Value addition and Food processing (vertical diversification), Soil and water conservation (water harvesting) along with drip irrigation setup, especially for orchards, Capacity building through popularization of low cost protected cultivation technologies for off season and exotic vegetables (horizontal crop diversification)

The region experiences an annual rainfall in the range of 1600 mm to 2000 mm. The farming of the region largely depends on rainfall and hence characterized as rain fed. However, some of the progressive and large-scale farmers have lift irrigation systems. The most common source of irrigation is lifting of water either from the Kameng River or from diversion of small streams of water from hilltops. Most of the farmers are facing problems in irrigating their orchards, as there is huge loss of rainwater due to the hilly and sloppy terrain. The shortage of water specifically encountered by orchard growers during winters due to insufficient rainfall during the season and lack of water conservation measures.

Farmers' issues and challenges

Major issues and challenges faced by the farmers of the region were worked out as per the data collected during Mela as well as farmers-scientist interaction (Figure 1). It is evident that input supply and resource management (37.2%) were the major issues faced by the farmers followed by knowledge in terms of technical knowhow (21.6%) and demonstration (21.6%). Further, it was observed that market (12.3%) and consultations (9.1%) were secondary issues. The primary reason behind the less emphasis on market availability issue was low productivity of scattered and marginal land holdings due to which there is lack of marketable surplus as most of the farm produce could hardly suffices the needs of family.

Since, the West Kameng district is a mid-altitude hilly region, the major environmental challenges such as undulated topography, slopy terrain, heavy rainfall and run-off and uneven distribution of rainfall throughout the seasons were the factors caused huge soil loss due to erosion and landslide. Moreover, torrential rainfall during rainy season coupled with high solar intensity made congenial environment for insect-pests and diseases to flourish abundantly in the region.

It is evident from the rank-based quotient (RBQ) analysis that maximum number of the farmers complained about the crop failure due to insect-pests and diseases outbreak causing significant crop loss. Hence, it came out to be one of the major challenges of the vegetable farmers followed by lack of technical knowhow, lack of fertilizers and manures and their untimely availability and lack of irrigation facilities (Table 2). The insect-pest and disease outbreak might be due to congenial environment for their multiplication along with lack of knowledge to identify their threshold limits and their effective management. However, lack of good quality agricultural inputs like high yielding variety of seeds, seedlings fertilizers and irrigation facility were also found to be equally important challenges.

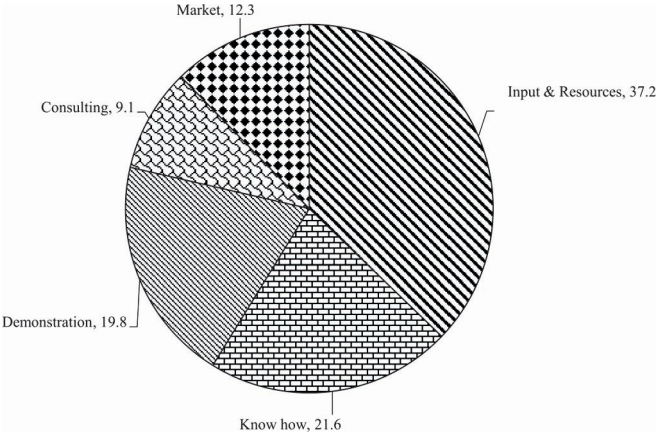

Figure 1. Farmers' issues and challenges

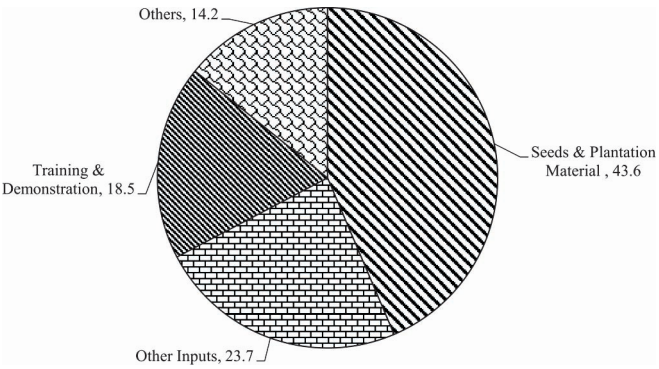

Figure 2. Impact of various interventions

Suggested solutions

The tangible solutions for three of the major problems were suggested in the form of problem solution trees (Figure 3). In addition**,** farmer-experts interaction came up with some suggestions for the issues, which the farmers might overlook, but equally important to mitigate the challenges of farming community are standardization of package of practices of major crops of the region including vegetable crops, field crops, medicinal and aromatic crops etc. to improve the agricultural productivity and their effective demonstration. However, encouragement of cooperative farming and establishment of custom hiring centers (CHCs) for agricultural inputs can significantly reduce the cost of cultivation and production and optimize the farm profits. Adoption of low cost protected cultivation technologies such as bamboo-based polyhouses, net

Table 2. Rank Based Quotient of the major challenges identified in the 11 villages of West Kameng district in Arunachal Pradesh

Agricultural problem	1	2	3	4	5	6	7	RBQ value	Rank
Paucity of quality seed material of field/vegetable crops	26	19	22	-	-	-	-	86.57	2
Lack of manures/fertilizer and their untimely availability	18	11	14	15	9	-	-	75.16	4
Lack of irrigation facilities	-	25	16	14	12	-	-	70.03	5
Crop Insect-pests and diseases outbreak	30	14	23	-	-	-	-	89.82	1
Unfamiliarity with the technical knowhow	25	12	20	10	-	-	-	86.00	3
Market availability	-	-	-	-	29	20	18	32.46	7
Weeds menace	-	-	-	21	12	15	19	38.20	6

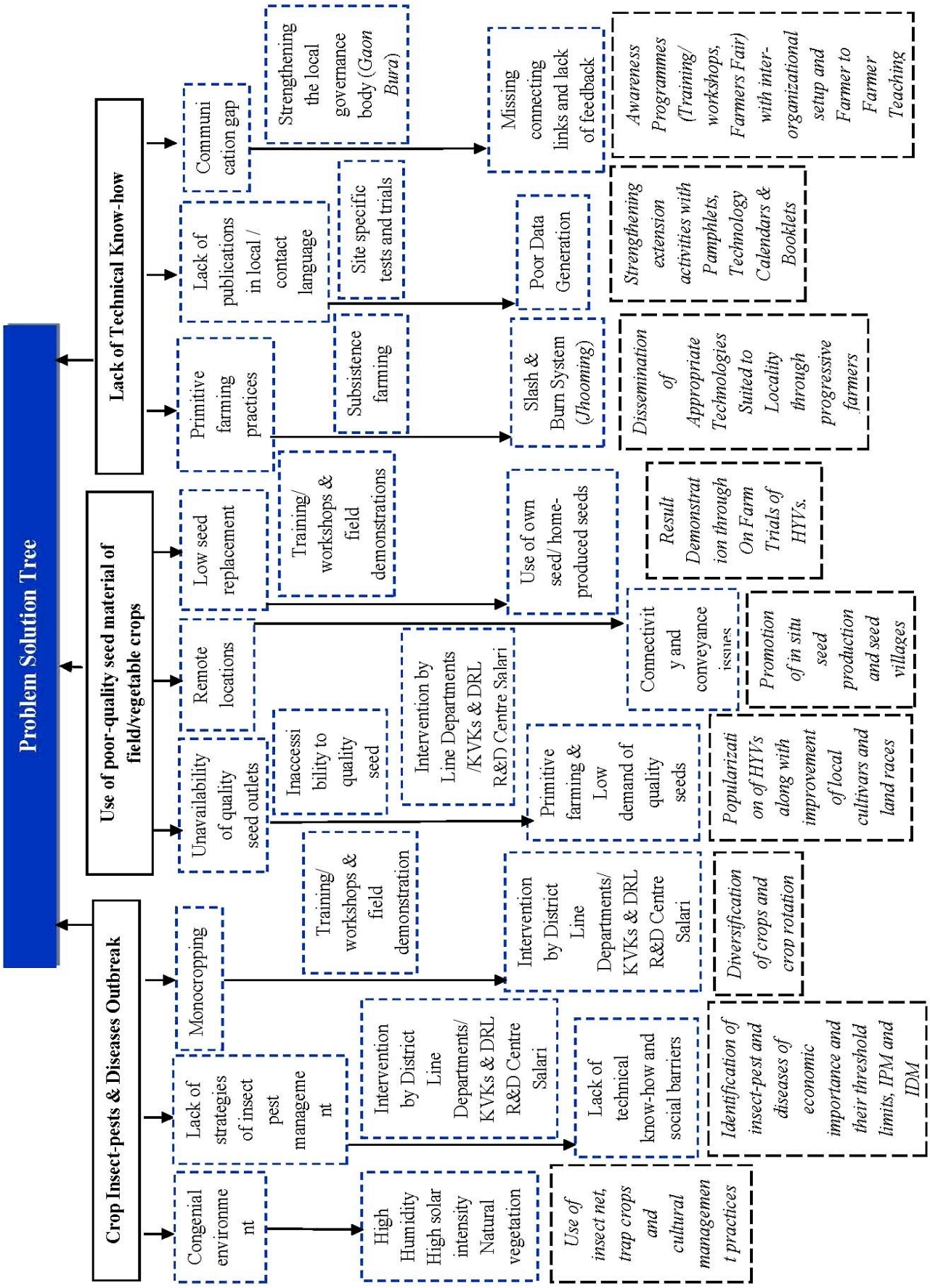

Figure 3. Problem Solution Tree for major agricultural problems of West Kameng District (Problem normal font; Solution(s) in *italics*)

houses, low tunnels, and bench terracing of the slopes ranging from 6.0 to 33 per cent etc. are some of modern agro techniques, which can be vital to agro-ecosystem sustainability and can aptly address the major challenges of farming community. Kalita et al., (2019) also found front line demonstration as an effective tool to increase productivity of rapeseed in Tirap district of Arunachal Pradesh.

Opportunities

West Kameng district being a part of Eastern Himalayan state Arunachal Pradesh is particularly rich and bestowed with a wide range of plant species and is considered a global hotspot of biodiversity (Myers et al., 2000). The soil of most of the region is fertile in terms of organic carbon and other essential nutrients for plants like potassium and magnesium. A wide range of crops ranging from field crops, fodder crops, spices and medicinal plants, fruits and vegetable to agro-forestry crops can be grown in West Kameng district. It is likely to fetch good prices and lead to economic improvement of the farmers of the region. Introduction of remunerative crops such as strawberry; improved cultivars of existing fruit crop and natural resource management has vast scope for improving agricultural productivity and for the advancement of existing agricultural practices through capacity building and technology demonstration (Table 1). This region is known for bumper production of quality oranges, persimmon, tomato, cabbage and ginger. Hence, there lies a good scope of post-harvest management including value addition and food processing of local produce for the prevention of spoilage and long-term storage. However, DRL R&D Centre (DRDO) at Salari has established a food processing cum skill development center. Training and demonstration of value addition techniques of locally available crop produce is conducted regularly at this center.

It was estimated that there is a huge gap of demand and supply of good quality seeds. It is evident that intervention in maintaining the supply chain of good quality seeds and plantation material (43.6%) followed by other agricultural inputs (23.7%) and organizing of training and demonstrations (18.5%) could make a significant difference in the current scenario of the farming sector of West Kameng district (Figure 2). Other interventions such as field days, farmers schools etc. may also have significant impact which need to be identified and implemented as per the suitability. Training of farmers and farm women has always been regarded as critical input for the rapid transfer of improved agricultural technologies (Kumar & Nain, 2013; Jaiswal et al., 2019). Bihari et al., (2017) also emphasizes priority training needs in soil and agronomical measures, *viz*. use and doses of plant protection chemicals, preparation of vermi-compost and commercial crop cultivation in high altitude areas of Uttarakhand.

CONCLUSION

The social scenario as evidenced in participant villages of West Kameng district of Arunachal Pradesh indicated a dire need of intervention to improve the basic infrastructure for the holistic improvement in agricultural enterprises and providing sustainable employment to the rural youth. The major issues such as outbreak of insect-pest and diseases; unavailability of high quality agro-inputs such as seeds and seedlings of high yielding varieties, untimely or poor availability of manures and fertilizers etc. addressed with due priority through trainings, demonstrations, field trials and on farm trials of modern agro-techniques. Though, farmers pointed out insect-pest problem as major issue, the availability of good quality seed material resistant to insect-pest attack and disease infestation could play a major role in bridging the gaps. The primary health care facilities are hard to reach in these villages and people are not even aware about basic health care and hygiene. Hence, the development-oriented interventions need to be done especially in providing primary health care facilities, safe disposal of fecal matter, veterinary aids to name a few. The frequent conduct of awareness programs for the adoption of profitable and sustainable agriculture practices along with various health and hygiene care aspects by dovetailing it with supplementary and complementary schemes may lead to revolutionary impact in these remote areas.

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