



Yield Gap Analysis and Impact of Potato Demonstration in 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

A field demonstration on potato was carried out during 2017-18 and 2018-19 respectively in Tirap district of Arunachal Pradesh by Krishi Vigyan Kendra (KVK) Tirap. Kufri Jyoti variety of potato with full scientific practices were demonstrated in 45 locations in selected villages. The size of demonstration plot was 0,1 ha. The demonstration yield was recorded as 282 and 304 q/ha respectively as compared 217 and 234 q/ha respectively. Technology gap was 36 & 16, extension gap was 65 and 70 while technology index was 11 and 5 respectively. Hence, it was observed that there was some gap in yield of potato in Arunachal Pradesh, India.

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Keywords: Extension gap; front line demonstration; potato; yield.

1. INTRODUCTION

The potato, or *Solanum tuberosum* L., is regarded as the third most significant crop for human consumption globally, right behind wheat and rice (International Potato Center, 2013). India is the country that produces the second most potatoes worldwide, after China, accounting for 38% of global production (PTI, 2020). Furthermore, potatoes, which currently occupy 21.8 lakh hectares and yield 52.5 MT, are regarded as India's fourth most important food crop after rice, wheat, and maize (Ojha & Saha, 2014). (Ghosh, 2020). After Uttar Pradesh (30.33%), West Bengal is one of the top potato-growing states in India, accounting for around 24.92% of the nation's output (NHB, 2022–23).

The farming of vegetables has become more commercialized. However, there is still a significant discrepancy between actual and prospective productivity. To provide food, nutrition and economic security for households, the nation urgently needs to increase the production of nutrient-dense food in a sustainable manner and boost farm family income. In Arunachal Pradesh, numbers of potato farmers are growing but the state's actual yield still lags far behind its potential. Therefore, there exists enough opportunity to enhance the productivity and production of potatoes in order to augment the income level of the state's farming population.

Since its introduction in the 1970s, yield gap analysis has been a powerful research tool. Utilized widely for measuring and analysing factors influencing yield gaps, it was created by the International Rice Research Institute (IRRI). There is a noticeable discrepancy between the actual yield that growers achieve and the production level that is realistically achievable with current technological enhancement, despite the fact that production has improved significantly in recent years. The current study evaluated yield loss in actual farming conditions and determined that insufficient supply of high-quality potato tubers from high yielding varieties (HYVs) and uneven application of N, P and K fertilizers were the main causes. In order to address the factors that contribute to yield erosion and reduced financial returns, the adoption and use of suggested technology

through demonstration was successfully implemented.

2. MATERIALS AND METHODS

The total forty five Front Line Demonstrations (FLD) on Potato were conducted at farmers' field in the Tirap district of Arunachal Pradesh during Rabi season of 2017-18 and 2018-19 respectively to assess its performance. The alltotal demonstrations were done in following villages: Khela, Chomoithung, Sipini, Dadam, Paniduriya and Subang. The soil of the district is generally sandy loam in texture. The area under each demonstration was 0.10 ha. Kufri Jyoti variety was demonstrated at farmers field with recommended package of practices. Before implementation of FLD, a field survey with potato growers done by Experts of KVK Tirap to know the reality of potato production viz. knowledge of farmer's variety, seed rate, production methodology, yield etc (Table 1). The farmers were replied that they are not using any critical input and also, they were growing old varieties of potato, that why their potato yield was poor.

The regular field visits by KVK scientists were made to ensure timely application of critical inputs and to solve other issues related to potato farming at field level. The other activities like – mobile advisories, group discussions etc., were also performed by KVK experts at the demonstration sites to provide opportunities for other farmers of the area.

Improved and suggested technologies were used as an intervention during the FLD to manage the assessed problem. As per the recommended practice, balanced fertilizer application of N:P:K: 100:40:60 kg/ha were applied along with farm yard manure @ 5kg/m². The opinions of farmers were gathered in order to boost research and extension programmes.

The discrepancy between the potential and actual farm produce is known as the "yield gap." Any yield that is obtained within the experiment station is referred to as potential yield. When the best available techniques and maximum inputs are used in trials conducted on the experiment station during a specific season, the production of the crop in the particular environment is regarded to be the yield. The yield attained on the demonstration plots on the fields of the

farmers under supervision of experts; is known as the demonstration yield. Regarding infrastructure and environmental circumstances, the conditions on the demonstration plots are very similar to those on the cultivators' fields. The yield that farmers really achieve on their properties while using their methods of farm management is referred to as actual yield.

The different following parameters viz. extension gap, technology gap, technology index (%) were worked out as per the work done by Samui et al., 2000 as given below:

Technology Gap =

$$P_i \text{ (Potential yield)} - D_i \text{ (Demonstration yield)}$$

Extension Gap =

$$D_i \text{ (Demonstration yield)} - F_i \text{ (Farmers yield)}$$

Technology index =

$$\frac{\text{Potential Yield} - \text{Demonstration yield}}{\text{Potential yield}} \times 100$$

Benefit Cost ratio (B: C ratio) =

$$\frac{\text{Net income (Rs ha}^{-1}\text{)}}{\text{Cost of cultivation (Rs ha}^{-1}\text{)}}$$

Percent increase of over farmer's practices =

$$\frac{\text{Improved practices} - \text{Farmers practice}}{\text{Farmers practices}} \times 100$$

3. RESULTS AND DISCUSSION

The performance of high yielding varieties of potato for the year 2017-18 and 18-19 was analyzed (Table 2). Data revealed that under demonstration plots, potato yield was found substantially higher than that under farmer's practice during both the year. Under different locations, the potato yield in demonstration plots ranged between 260 to 318 q/ha, which was 29-30 percent higher over farmers practice (local check). The different researchers have also been reported that high yielding varieties under balanced nutrients management resulted good yield [1,2]. Mishra et al. [3] has also reported that potato recorded higher yield under proper

nutrient management condition in Malwa region of Madhya Pradesh. Kumar et al. [4] has also reported that integrated nutrient management resulted better yield of potato under rainfed climatic conditions in Meghalaya. Mohapatra et al. [5], Mollah [6], Saini [7], Singh [8] and Venkatasalam [9] has also confirmed the result.

Between the potential yield and the yield of the demonstration plots is called "technology gap." That was measured in both study years and came to 38 and 16 kg/ha with an average of 27 q/ha (Table 2). Different soil fertility statuses, agricultural methods and local climate conditions may be the cause of the observed technology difference. Mishra et al. [10] has also reported that potato yield can be increased by adopting the good management practices of blight control. He reported that blight is the major factor in potato cultivation.

The Extension gap was 65 and 70 q/ha (Table 2), respectively, based on data that was recorded. The study revealed that the average extension gap was 67.5 q/ha. This underscores the necessity of educating farmers through different extension methods, such as FLD, to encourage the use of new agricultural technology and reverse the trend of vast extension gaps [11,12].

The viability of evolving technology on farmers' fields was demonstrated by the technology index. The more feasible technology is, the lower the technology index value. Mishra et al. [10], Saini et al. [7] and Singh et al. [8] reported that variations in soil fertility level, weather, insect pests and illnesses could be the cause of the technology index's fluctuation, which ranged from 1.0 to 7.2% over the study period [13].

The technology index was reported to be 8% on average, indicating the good performance and efficacy of technical solutions. There exist adoption gaps between the farmers' practices and the shown plots and since the farmers can see the very obvious outcomes between these plots, this leads to the adoption of the technology automatically.

Table 1. Improved practices vs farmer's practices of Potato

Particular	Technological intervention	Existing practices	Gap
Variety	Kufri Jyoti	Very Old variety	Full gap
Seed rate	25-30 q/ha	40 kg /ha	Partial gap
Seed treatment	Seed was treated	Not treated	Full gap
Sowing method	Line sowing	Line sowing	Partial gap
Spacing	60 x 20 cm with 6 cm depth of sowing	60 x 30 cm with 8 cm depth of sowing	Partial gap
Application of recommended dose of manure	5 kg/ meter ²	Nil/without recommendation	Full gap
Application of Bio fertilizer	Soil application of Azospirillum & PSB @ 2 kg/ha mix with FYM	No application	Full gap
Weed management	Done at 25 and 45 days after planting	Not common	Full gap
Harvesting	Manual	Manual	No Gap

Table 2. Production and different extension parameters of Potato

Year	Area	Variety	No of Demos.	Potentia I Yield	Average Yield (q/ha)		% increase over Check	Technology gap (q/ha)	Extension gap (q/ha)	Technology index (%)
					D	C				
2017-18	2	Kufri Jyoti	20	320	282	217	29	38	65	11
2018-19	2.5	Kufri Jyoti	25	320	304	234	30	16	70	5

Where D stands for Demonstration and C stands for Check

During the interview with farmers; two important points were raised as major problems and issues, they were-

- ❖ Lack of quality potato tubers in market.
- ❖ Lack of awareness about balance dose of fertilizers use in field at proper time.

4. CONCLUSION

The Frontline demonstration program is very effective programme where farmers are getting experience at their own field; which also motivate neighboring farmers. In this way efficacy of the scientific package of practices among farmers increases.

The yield gap analysis revealed that the losses could be increased by 29 – 30 %. The technology gap 16-38 q/ha and can be attributed to dissimilarity of the soil fertility and local climatic situation. Extension gap was 65 - 70 q/ha, which needed better extension approaches to dissemination of improved cultivation practices among farming community. The technology index indicates the viability of the technology exhibited and the effectiveness of the intervention points implemented to close the potato yield gap.

It is suggested for the awareness and technical knowledge for the farmers level from the concerned agencies and the government support in the study area together with proper market link.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) 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 this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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