**Yield Gap and economic analysis of Front Line Demonstration on Coriander (***Coriandrum sativum L.***) in District Budgam of Jammu and Kashmir.**

**Abstract**

The study was conducted to assess the yield and suitability of newly released coriander variety Shalimar Dhania -1 through front line demonstration in District Budgam for four consecutive years 2019, 2020, 2021 and 2022. A total of 40 FLD’s per year were distributed in different villages of District Budgam. Data was collected for yield per ha. Technology gap (q/ha), Extension gap(q/ha) and technology index(%) was also worked The results obtained reveals that the improved variety was having higher yield and hence better returns to the farmers as compared to the local variety. Study also revealed a wide gap in the production technology of coriander. The farmers themselves observed the difference between the improved variety and local. The pooled data over years showed yield increase of 15.16% over the control and B: C ratio of 3.52 in demonstration plot (2.61 in control). Pooled data showed technology gap of 1.35q/ha**,** Extension gap of 8.97q/ha and technology index of 1.94 %. It may be attributed to scientific cultivation method viz proper selection of variety, use of quality seed, seed treatment, proper spacing, recommended dose of fertilizers and integrated pest management.

**Introduction**

 **Coriander** ( *Coriandrum sativum L.*) is an [annual](https://en.wikipedia.org/wiki/Annual_plant) [herb](https://en.wikipedia.org/wiki/Herb) in the family [Apiaceae](https://en.wikipedia.org/wiki/Apiaceae%22%20%5Co%20%22Apiaceae). It is also known as **Chinese parsley**, **dhania**, or **cilantro**. All parts of the plant are edible, but the fresh leaves and the dried seeds (which are both a [herb](https://en.wikipedia.org/wiki/Herb) and a [spice](https://en.wikipedia.org/wiki/Spice)) are the parts most traditionally used in cooking. It is perennial plant but grown as an annual which requires well-draining fertile soil supplemented with warm summer climates to flourish. The plant reaches about 1 to 2 feet in height and features dark green, hairless, soft leaves that vary in shape; broad-lobed near the base, and slender and feathery higher up near its flowering stems. The leaves and stem possess slightly citrus flavour. The plant bears umbels of small white or light pink flowers in mid-summer, followed by round-oval shaped aromatic seeds. [Coriander seeds](http://www.nutrition-and-you.com/coriander-seeds.html), used as spice, are round-to-oval in shape, yellowish brown in colour with vertical ridges and have a flavour that is aromatic, sweet and citrus, but also slightly peppery. In India, coriander occupied an area of 46800 ha with production of 56700 tonnes during 2018-2019 (NHB). Although agro-climatic conditions of Kashmir valley are quite congenial for the cultivation of coriander crop but acreage as well as production of this crop is still low. One of the reasons for this low production and acreage may be lack of improved package of practise and high yielding varieties. Use of good quality seed of recommended variety along with application of recommended dose of fertilizers at appropriate time and adopting need-based plant protection measures against insect pests and diseases are efficient measures for reducing knowledge gap of farmers and enhancing productivity and profitability of coriander in UT of Jammu and Kashmir. However, Kumar *et al.* (2017) mentioned that the major constraints responsible for lower yield are adoption of inappropriate production technologies by farmers viz., broadcast method of sowing, imbalance use of fertilizer and untimely application, lack of awareness regarding plant protection measures and poor weed management. The improved practices packages were also found to be financially attractive. Yet, adoption levels for several components of the improved technology were low, emphasizing the need for better dissemination (Kiresur *et al.*, 2001). The extent of adoption of improved production technologies are a crucial aspect under innovation diffusion process and the most important for enhancing agricultural production at a faster rate. The main objective of the study was to demonstrate and popularize the improved agro-technology at farmers’ fields under varied existing farming situations. Front line demonstrations aim at demonstrating the superiority of a package of practice in growing a crop. These are mainly related to latest released varieties, agronomic management of crops, methods to control disease and pests, technologies to increase yields and to reduce cost of production.

 **Material and Methods**

The study was carried at KVK Budgam in Jammu and Kashmir from year 2018-2022. A high yielding newly released variety SKUAST-K of Coriander “Shalimar Dhania-1 was used in the study. The seeds were provided to 40 beneficiaries each year of different villages (Warpora, Galwanpora, N S Pora, Hajibagh, Harran, Soibugh, Nagbal, Drang etc.) of District Budgam. The data obtained during 4 years of experiments was pooled over years. The farmers were provided with all the improved package of practices as per SKUAST-K recommendations and the gap in adoption of new technologies was also worked out. Observations were recorded on the yield and compared with the local check and pooled over four years. The economics was also worked out. Other extension activities including training programmes, group meetings and field days were also organized at demonstration sites to create awareness among farming community of neighbouring areas about the advantages of demonstrated technologies. The economic viability of improved demonstrated technology over farmers practice was calculated depending upon prevailing price of inputs and outputs cost and represented in the term of B: C ratio. Percent increase in yield was calculated using following formula:

 Percent increase yield = Demonstration yield-Farmer’s Yield

 Farmer’s yield

 To estimate the technology and extension gap and the technology index the formulae used are as follows: (Samui *et al.*, 2000).

 Technology gap = Potential yield – Demonstration yield

 Extension gap = Demonstration yield – Farmers yield

 Technology index = Technology gap X 100

 Potential yield

**Table 1:** **Existing farmer’s practices and improved practices demonstrated through frontline demonstration on Coriander at farmer’s field in Budgam district of Jammu and Kashmir.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S.no.** | **Cultural Operations** | **Farmers practice** | **FLD Employing Improved cultivation practices** | **Gap %** |
| 1  | Variety  | Local  | Shalimar Dhania-1  | 100 %  |
| 2  | Sowing time  | Aug-Sep and Feb-Mar  | Aug-Sep and Feb-Mar  | No gap  |
| 3  | Seed quality  | Low quality seed  | High quality seed  | 100%  |
| 4  | Seed treatments  | No treatment  | Seeds treated with thiram @2g/kg seed  | 100%  |
| 5  | Seed rate  | 20-25kg/ha  | 10-15kg/ha  | 100%  |
| 6  | Method of sowing  | broadcasting  | Line sowing  | 100%  |
| 7  | Spacing  | Not maintained  | 15-20cm between lines  | 100%  |
| 8  | Fertiliser application  | Indiscriminate use  | 10-15 t/ha FYM, 125 kg urea, INM: 75kg urea +1.5t/ha vermi compost  | 100%  |
| 9  | Farming situation  | Irrigated  | irrigated  | No gap  |
| 10  | Pest Control measures  | Indiscriminate use of pesticides  | As per recommendation  | 100%  |
| 11  | Handling of pesticides  | No safety measures undertaken  | Use of all safety measures. (gloves, glasses, mask etc)  | 100%  |

**Results and Discussion**

**Comparison of Production Practices**

 It was evident that farmers generally did not follow recommended and improved technologies which created a wide gap for coriander production (Table 1). Farmer’s adopted higher seed rate against the recommended optimum seed rate resulting in higher cost of seed input. Farmers also did not practice seed treatment, as seed treatment protects seeds from seed and soil-borne diseases. However, many farmers in the country are neither familiar with the practice nor follow it instead of many efforts by agriculture scientists and officials from the line departments.

**Yield**

 The observations pertaining to leaf yield and economic analysis of coriander crop in demonstrated field’s and farmer’s practice is presented in Table 3. The yield of coriander pooled over four years reveals that demonstration plots yields higher when compared to farmer’s plots. The percent increase in yield of demonstration plots over farmer’s plots was recorded as 15.16 per cent. The increase in yield of demonstration plots was mainly due to the improved package of practices. Use of Shalimar Dhania -1 seed not only improved the yield of the crop but also decreased the incidence of disease. Introduction of seed treatment, applying fertilizers based on soil test values and adoption of plant protection measures followed under FLDs really jumped the yield of coriander compared to farmers` practices. It was evident that the yield of demonstration was found better than the farmer’s practice under the similar environmental conditions. Farmers who didn’t adopt these technologies were motivated by results of demonstrations and agro-technologies followed in the FLDs and were willing to adopt these all-new technologies in their fields in future (Table 2). These findings were in corroboration with the findings of Sharma (2013), Dwivedi *et al* (2014), Khedkar *et* *al* (2017), Patil *et al* (2018) and Singh (2020).

**Technology Gap**

 The technology gap is the difference between potential yield of the variety and yield observed in demonstration plot. The technology gap during 2019, 2020, 2021 and 2022 was 0.96, 2.29, 1.40 and 0.74 q/ha respectively (Table 3). The observed technological gap may be attributed due to dissimilarity in the soil fertility status, availability of moisture content and management of insect pests and diseases. Similar findings were observed by Kumar *et al* (2020), Meena *et al* (2021) and Nabi *et al* (2021).The results indicate that a gap existed between technology evolved and technology adoption at farmer’s field. Less technology gap revealed better adaptability of crop variety in a particular area. Hence to reduce the yield gap, it is necessary to grow varieties suitable for a given area and timely sowing.

 **Extension gap**

Extension gap is the difference between the yield of demonstration plot and farmer’s plot. Extension gap of 10.16, 7.95, 8.34 and 9.44 q/ha was observed during the years 2019, 2020, 2021 and 2022 respectively (Table 3). Implementation of recommended package of practices along with high yielding varieties as suggested by the SKUAST-K subsequently helped in increasing the yield in demonstration plots. The extension gaps created need to be emphasized by educating and motivating the farmers through various extensions means to implement the improved production technologies. More extension gap indicates the high acceptance of advanced technologies. The present study was in line with earlier findings of Kumar *et al* (2020).

**Technology index**

The technology index represents the feasibility of the evolved technology at the farmers’ fields. The lower values of technology index indicate more feasibility of the technology to go through farmer’s field. Lowering the technology index values indicated greater technology feasibility. It indicates the efficacy of a good performance of relevant interventions or technologies demonstrated in farmer’s field. Maximum technology index value (3.29 per cent) was noticed during 2020 while, minimum value of technology index (1.06 per cent) was noticed during 2022 (Table 3). Moreover, reduction of technology index over the years of study clearly indicted the feasibility of technologies demonstrated in frontline demonstrations. Similar findings in reducing the technology index by adopting the FLDs were also noticed by Saikia *et al* (2018) and Singh *et al* (2020).

**Economic Returns**

 The economic performance of coriander under FLD programme is depicted in Table 2. The economic analysis revealed that during all the years of demonstration, gross returns, net returns and benefit: cost ratio was higher in demonstrated plots compared to farmer’s practice indicating higher profitability. The benefit cost ratio of demonstration plots was 3.7, 3.53, 3.44 and 3.41 during the years 2019, 2020, 2021 and 2022 respectively (Table 2). Pooled data reveals B:C ratio of 3.52 in demonstration plot against 2.61 in check . Hence, by adopting improved production practices in coriander, yield potential and economic returns of the farming community of Budgam district can be raised. These results were in line with the earlier findings by Singh *et al* (2020), Kumar *et al* (2020) and Nabi *et al* (2021).

 **Table 2: Yield performance and economic indicators in coriander**

|  |  |  |  |
| --- | --- | --- | --- |
| **year** | **Yield (q/ha) green leaf**  | **%****Increase**  |  **Economics (Rs./ha)**  |
| **Gross Expenditure (Rs)** | **Gross Return (Rs)** | **Net Returns (Rs)**  | **BCR** |
| **Demo**  | **Check**  |
| **Demo**  | **Check**  | **Demo**  | **Check**  | **Demo**  | **Check**  | **Demo**  | **Check**  |
| **2019**  | 68.56 | 58.40 | 17.39 | 73962 | 90491 | 274240 | 196200 | 200278 | 143109 | 3.70 | 2.58 |
| **2020**  | 67.23 | 59.28 | 13.41 | 76000 | 90500 | 268920 | 190800 | 192920 | 146620 | 3.53 | 2.62 |
| **2021** | 68.12 | 59.78 | 13.95 | 78980 | 90650 | 272480 | 189000 | 193500 | 148470 | 3.44 | 2.63 |
| **2022** | 68.78 | 59.34 | 15.90 | 80453 | 90780 | 275120 | 198600 | 194667 | 146580 | 3.41 | 2.61 |
| **pooled**  | **68.17** | **59.2** | **15.16** | **77349** | **90605** | **272690** | **193650** | **195341.3** | **146194.8** | **3.52** | **2.61** |

 **Fig1: leaf yield in Demo and Check plots in Coriander**

**Table 3:** **Technology Gap, Extension Gap and Technology Index of Coriander crop in Budgam District of Jammu and Kashmir.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Year | Area (ha) | No of FLDs | Variety | Technology Gap (q/ha) | Extension Gap (q/ha) | Technology Index (%) |
| 2019 | 2.0 | 40 | Shalimar Dhania -1 | 0.96 | 10.16 | 1.38 |
| 2020 | 2.0 | 40 | Shalimar Dhania -1 | 2.29 | 7.95 | 3.29 |
| 2021 | 2.0 | 40 | Shalimar Dhania -1 | 1.40 | 8.34 | 2.01 |
| 2022 | 2.0 | 40 | Shalimar Dhania -1 | 0.74 | 9.44 | 1.06 |
| Pooled  |  |  |  | **1.35** | **8.97** | **1.94** |

Fig 2- Bar graph showing yield gaps

**Conclusion**

From the study it can be concluded that SD-1 yields higher than the local check which results in higher returns to the farmers. The farmers were highly satisfied with the variety in terms of yield as well as aroma of the crop. They got well versed with the impact of scientific cultivation of the crop as demonstrated from time to time

**References**

Dwivedi AP, Mishra Anupam, Singh SK, Singh SRK, Singh Mamta. 2014. Yield gap analysis of chick pea through frontline demonstration in different agro climatic zones of MP and Chhatisgarh. *Journal of Food Legumes*. 27(1):50- 63.

Khedkar R, Shinde V and Chaudhari P. 2017. Role of cluster frontline demonstrations in enhancement of chickpea production. *Journal of Krishi Vigyan* 6(1):940-942.

 Kiresur VR, Rao SVR and Hedge D M.2001. Improved technologies on oilseeds production- An assessment of their economic potentials in India. *Agril Econ Res Rev* 14: 95–108.

Kumar V, Sharma V and Sharma SC. 2014. Impact of improved technologies on productivity enhancement of sesame (Sesamum indicum L.). *Indian Journal of Dryland Agriculture Research and Development* 29(2): 41–44.

Meena M S, Singh SK, Meena HN, Meena RK and Choudhary A. 2021. An assessment of extension, technological gaps and income augmentation through participatory CFLD on Chickpea in Rajasthan. *Journal of Food Legumes* 34(3):205-209.

 Nabi Ambreen, Akhter S, Dar N. A., Yousuf V, Sofi K A, Farooq I and Akhter A. 2021. Evaluation of Turnip (*Brassica rapa* L.) var PTWG for yield and relative economics under Frontline Demonstrations in District Budgam. *Current Journal of Applied Science and Technology* 40(23): 58-63.

 Patil SS, Mahale MM, Chavan SKS. 2018. Impact of frontline demonstration on oilseed crops in South Konkan coastal zone of Maharastra. *Current Agriculture Research Journal*. 6(3): 355-364

Saikia N, DebNath K, Chowdhury P. 2018. Impact of cluster frontline demonstrations on popularization of blackgram var. PU 31 in Cachar district of Barak Valley region of Assam. *Journal of Pharmacognosy and Phytochemistry*. 7(4):940-942.

Samui, S.K., Maitra, S., Roy, D.K., Mandal, A.K. and Saha, D. Evaluation of Front Line demonstration on groundnut. *Journal of Indian Soc. Coastal Agric. Res*., 18: 180-183 (2000).

Sharma R, Arora D, Choudhary P. C. and Porwal R. 2013. Improvement of productivity of Coriander (*Coriandrum sativum* L.) through front line demonstrations. *International Journal of Seed Spices* 3(1):68-69.

Singh N and Singh A.K. 2020. Yield gap and economics of Cluster Frontline Demonstrations (CFLDs) on pulses under rain-fed condition of Bundelkhand in Uttar Pradesh. *International Journal of Advanced Research in Biological Sciences*: 7(8): 1-7

Singh M, Dwivedi V, Deo K And Parwez A. 2020.Quantifying yield gap minimization in chickpea under cluster front line demonstration conducted in Indo Gangetic plains of eastern India. *Journal of Agri Search* : 7 ( 3)