Impact of front line demonstration on productivity of fennel cv. AF 2 through drip and fertigation in tribal belt of Korea district (Chhattisgarh)

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Abstract
A front line demonstration was conducted at five farmers’ fields comprising of 0.20 ha each in Korea district of Chhattisgarh during Rabi 2017-18 to 2019-20 to demonstrate the improved package of practice of Fennel var. AF 2. There were two treatments in which one was local check and second was cultivation of improved variety of fennel with full package of practice under drip and fertigation. Field diagnostic visits, regular surveys, farmer meetings and training programmes ensured application of balanced and optimum doses of nutrients through fertigation and timely plant protection measures. The result revealed that local check gives a yield of 4.12 q/ha. While fennel cultivation with full package of practices along with drip and fertigation gives a yield of 16.56 q/ha, which shows that by adopting package of practices there were 308.73 % increase in fennel seed yield. Similarly, net return was also calculated which shows that local check gives a net income of Rs. 7507/ha with a B:C ratio of 1.44 against a net income of Rs. 38659/ha with B:C ratio of 1.62 in demonstration field. With frontline demonstration (FLD) of proven technology revealed that yield potential and net income from fennel cultivation could be enhanced to a great extent resulting in higher income to the farming community. By conducting front line demonstration (FLDs) of proven technologies, yield potential of fennel can be increased up to great extent. This will substantially increase the income as well as the livelihood of the farming community. The extension gap and technology gap ranged between 12.51 to 13.07 and 82.25 to 98.25 q/ha, respectively, with the technology index of 6.90 per cent during the demonstration years. Besides this, the demonstrated plots gave higher gross return, net return with higher benefit cost ratio when compared to farmer’s practice.

Keywords: fennel, front line demonstration, farmers practice, drip irrigation, fertigation, yield

Introduction
India, the land of spices is the largest producer, consumer and exporter of spices in the world. In India, wide varieties of spices are grown and many of them are native to the subcontinent and also known as “Home of Spices”. (Meena and Singh, 2012) [6]. Among the spices, seed spices are the group, which denotes all those annuals whose dried fruit or seeds are used as spices. The seed spices are aromatic vegetable products of tropical origin and are commonly used in pulverized form, primarily for seasoning or garnishing the foods and beverages. They are also used in preparation of various value added products viz., spice oils, oleoresins and spice powders. Fennel (Foeniculum vulgare Mill.) plant is stout, aromatic, annual herb (with potency of regeneration) belongs to family Apiaceae. Fennel is mainly grown for its seeds which have pleasant fragrance, an aromatic taste and it is widely cultivated throughout the temperate and subtropical region of the world (Giana et al., 2019) [2]. In India, fennel is mainly grown in Gujarat and Rajasthan and to some extent in Uttar Pradesh, Karnataka, Andhra Pradesh, Punjab, Madhya Pradesh, Bihar, Haryana and Jammu & Kashmir (Godara et al., 2013) [3]. It is used as condiment and culinary spice. The seeds contain about 9.5 per cent protein, 10.0 per cent fat, 42.3 per cent carbohydrates, 18.5 per cent fibre and 13.4 per cent minerals. Reduced agricultural productivity and water use efficiency are mainly due to conventional method of irrigation (flooding) and poor adoption of scientific water management practices. Availability of irrigation water is limited and therefore, it should be utilized most efficiently by adopting latest irrigation technologies (Patel et al., 2000) [10]. Therefore, drip method of irrigation is most suited for semi-arid and arid areas where water is scarce and where low water consuming and high value crops can be grown. Drip method of irrigation helps to reduce the over exploitation of ground water that partly occurs because of...
inefficient use of water under surface method of irrigation (Meena et al., 2017) [7]. Fertigation is one important precision farming technique which can give better nutrient use efficiency as compared to surface irrigation method. Application of nutrients untimely, following inappropriate method of application leads to severe loss of nutrients by leaching and fixation (Harisha et al., 2017) [9]. Application of fertilizer in small quantities to the soil at any given time improves fertilizer use efficiency, helps to maintain nutritional balance and nutrient concentration at optimum level, saves energy and labour, provides opportunity to apply the nutrient at critical stages of crop growth and minimizes hazard of ground water. Information on water requirement by drilled rabi fennel and fertigation is lacking for Korea region. among the various factors contributing towards the attainment of potential yield and quality of fennel. With an objective to combat the causes of poor yield and low economic returns, dissemination of recommended technology through frontline demonstration was attempted in the Korea district of Chhattisgarh.

Material and methods
Krishi Vigyan Kendra, Korea carried the technology to the farmers field through frontline demonstrations in the villages viz Pusla, Umjher and Dudhaniya between 2017-18 and 2019-20. The average area under each demonstration was 0.20 ha with 5 beneficiaries in each demonstration. Through field diagnostic visits, surveys, farmer meetings etc the factors contributing to low productivity like varietal issues, faulty management practices, lack of irrigation, poor nutrient management, negligent plant protection measures were identified. The genuine seed of fennel variety A.F.-2 was procured and distributed to selected farmers. All the participating farmers were trained on various aspects of fennel production technologies. The field was prepared by deep ploughing and harrowing after Kharif crops. The seeds were sown in well prepared field during first week of October. All the recommended practices i.e. seed treatment by carbendazim @ 2.3g/kg seed, sowing by seed cum fertilizer drill maintaining row spacing of 40-50cm and by thinning keep plants at 25-30 cm spacing with in rows. Locally cultivated variety of fennel as practiced by the farmers with their own management system was taken as the farmers practice The data related to cost of cultivation, production, productivity, total return and net return were collected in both treatments as per schedule from all selected farmers. An average of cost of cultivation, yield, net returns of different farmers was analyzed by the formula. The drip irrigation system was installed and operated daily except on rainy days to provide the sufficient moisture to the plants. The lateral lines were laid parallel to the crop rows and each lateral served two rows of crop. The laterals were provided with on line emitters of 4 lt hr⁻¹ discharge capacity. Emitters were fixed 0.3m apart to serve the irrigation water requirement of four plants. Inline drippers with a discharge rate of 4 lt hr⁻¹ was followed for all the plants spaced at 30x 15cm. Fertigation is done as per the recommended dose with 60:50:120 NPK kg of NPK/ha and is applied throughout the cropping period once in three days. Water soluble fertilizers like 19:19:19, 0: 0:50 and urea are used. The scheduling interval of fertigation was followed at weekly intervals for 13 weeks starting from 5th to 17th week after planting in the field. All other steps like site and farmer selection, layout of demonstration, farmers’ participation etc were followed as suggested by Choudhary (1999) [1]. In case of local check (control plots) no change was made in the existing practices of imbalanced use of organic and inorganic fertilizers and little or no use of fungicides and pesticides. Well before the demonstrations training was imparted to the farmers and their exposure visits to the KVK instructional-cum demonstration farms were conducted. Visits of the farmers and the extension functionaries were also organized to demonstration plots to disseminate the message at large. Yield data were collected from the control and demonstration plots and cost of cultivation, net income and benefit/cost ratio were computed.

Results and discussion
Performance of Fennel var AF 2 under drip and fertigation was found to be substantially higher under the demonstration plots than under control during all the demonstration years (Table 1). The seed yield under demonstrations was 16.56, 16.94, 17.02 q/ha during 2017-18, 2018-19, and 2019-20 respectively. The findings are confirmed with the findings of Godara et al., 2013 [3], Meena et al., 2017 [7], Harish et al., 2017, Giana et al., 2019 [2] The yield enhancement due to technological intervention was to the tune of 308.88, 289.42 and 330.89 per cent over control. The cumulative effect of technological intervention over three years revealed an average yield of 16.56 q/ha i.e. 308.73 per cent higher over local check. The year-to-year fluctuations in yield and cost of cultivation can be explained based on variations in microclimatic conditions and marketability price. Mukherjee (2003) also reported that depending on identification and use of growing situation specific interventions may have greater implications in enhancing systems productivity. Similar variations in results have been documented Tiwari and Saxena (2001) [13], Tiwari et al (2003) [14], Tomar et al (2003) [15], Mishra et al (2009) [9], Rajaraman et al., 2010 [11] and Kumar et al (2012) [5] in different crops. The data clearly reveal that the net returns from the demonstration plots were substantially higher than control plots during all the years. An average net return was observed to be Rs 38659 in comparison to control plot i.e Rs 7507. Thus, on an average additional income of Rs 31153 is attributed to the technological intervention provided in demonstration plots. Economic analysis revealed that benefit/cost ratio in demonstration plots was comparatively higher than control plots. The highest benefit cost ratio (1.63) was observed in the year 2017-18 followed by 1.62 in the year 2018-19. The variation in B:C ratio could be due to price variation during the study years. The average B:C ratio of demonstration and control plots was 1.62 and 1.44 respectively during the study period. Hence, favourable B:C ratio proved the economic viability of the intervention made under demonstration and convinced the farmers on the utility of intervention. Similar findings were reported by Godara et al., 2013 [3], Meena et al., 2017 [7], Harish et al., 2017, Solanki et al., 2017 [12] and Giana et al., 2019 [2] in fennel.

Technology gap, Extension gap and Technology index
It is evident from data (Table 1) that the on an average technology gap, the differences between potential yield and yield of demonstration plots was 1.16q/ha. The technology gap observed may be attributed to dissimilarity in the soil fertility status, agricultural practices and local climatic situation. On an average extension gap of 12.72q/ha was observed during the trial which emphasized the need to educate the farmers through various extension means i.e. front line demonstration for adoption of improved production and
References