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Sonam Spaldon

High Mountain Arid Agriculture
Research Institute, SKUAST-K,
Leh, Ladakh, India

MS Kanwar

High Mountain Arid Agriculture
Research Institute, SKUAST-K,
Leh, Ladakh, India

Jigmet Laskit

Krishi Vigyan Kendra,
Leh, Ladakh, India

Anwar Hussain

High Mountain Arid Agriculture
Research Institute, SKUAST-K,
Leh, Ladakh, India

Kunzes Angmo

High Mountain Arid Agriculture
Research Institute, SKUAST-K,
Leh, Ladakh, India

Corresponding Author:

Sonam Spaldon

High Mountain Arid Agriculture
Research Institute, SKUAST-K,
Leh, Ladakh, India

Offseason broccoli (*Brassica oleracea* var *italica*) cultivation under low tunnel in eastern Ladakh (UT)

Sonam Spaldon, MS Kanwar, Jigmet Laskit, Anwar Hussain and Kunzes Angmo

Abstract

Broccoli is newly introduced in lowtunnel as crop diversification to this region. whereas open cultivation is not possible due to unfavorable climatic conditions. Lowtunnel act as protection against frost injury during the initial growing period and were evaluated in three different locations. The yield recorded in broccoli hybrid Lucky was 400 qtl/ha followed by hybrid Fiesta (350 qtl/ha) with a high economic return of INR 1086200 /ha with high benefit-cost ratio of 1:9 followed by hybrid *Fiesta* with benefit-cost ratio of 1:75. Sensing the importance and nutraceutical rich crop cultivation of broccoli is succeeded immensely in this region.

Keywords: Broccoli, lowtunnel, cold arid, economics, nutraceuticals

Introduction

Broccoli (*Brassica oleracea* var. *italica* L.) is a native of the eastern Mediterranean region and Italy is a center of diversification (Singh and Nath, 2012) [7]. The first selection of sprouting Broccoli was probably made in Greece and in the Pre- Christian era (Heywood, 1978) [2]. It is an excellent source of nutraceuticals (Daniel and Daniel, 2016) [1] and contains high concentrations of vitamin C, which act as a potent antioxidant, helping to prevent atherosclerosis and cancer (Padayatty, 2003) [5]. Calcium content in broccoli is equivalent to that in milk (47mg/100gm). It has 130 times more vitamin A than cauliflower and 22 times more than cabbage (Pankaj *et al.*, 2018) [6]. The nutritional value of Broccoli has garnered the spotlight in recent years and now viewed as one of the “top powerhouses” when it comes to nutrient density and benefits.

Broccoli is an emerging crop in the Ladakh region for the past few years with rising in tourism. It comes well under open field conditions up to 11500 ft an MSL during the summer season and fetches a very high price in the market. Whereas its cultivation is restricted above 12500ft Amsl in open conditions and is introduced under low tunnel as crop diversification in eastern Ladakh (Changthang). The temperature touched from -5 to -28 °C during winter and rarely touching 30 °C in summer (Fig1). The inhabitants are mainly nomadic shifting from one pasture to another with their livestock in search of food throughout the year. This crop which initially the farmers were skeptical to grow is now found in every household of Nyoma and its adjoining villages. They also fetch them a good price as the products are purely organic so ultimately raising their livelihood. Sensing the importance of vegetable crops as nutritional security, broccoli an important nutraceutical-rich crop is introduced in the Changthang region by KVK Nyoma at an altitude of 14000ft under low tunnel.

Material & Method

The present study was conducted by Krishi Vigyan Kendra Nyoma via Front line demonstration at three different locations viz., Nyoma, Mudh and Tsaga (Table 1) for two consecutive years during the summer season 2018-19 to 2019- 2020. The coordinates of the study site were recorded using GPS device (Oregon-650, Garmin Ltd, Taiwan). Two varieties of Broccoli hybrids *fiesta* and *Lucky* were evaluated. The soil of the area under study was sandy loam with low organic matter content. Fifteen farmers were selected for the demonstration under study. The quality seed is sown in underground technology (trench) at KVK Nyoma farm in the month of 2nd week of April when the outside temperature is below freezing point (-4.9 °C) and all agronomic practices are followed from time to time to get healthy seedlings.

The nursery was ready for transplanting in 43-45 days and proper hardening is done one week prior to transplanting through regular opening of trench polythene during daytime. Nursery were uprooted, packed and taken to farmer field in the month of mid May.

The bed was prepared well at farmers field with proper ploughing followed by incorporation of well decomposed sheep and goat manure (Locally called *Rigpa*). Low tunnel is cheapest portable protected structures were installed at farmer’s fields with a dimension of 1m width, 1m height and length as per requirement. The wire is inserted 15cm deep into the soil keeping 1m distance from wire to wire and tied with thread to hold the polythene tightly (Fig. 2). Seedlings are transplanted at a spacing of 30 x 30 cm followed by irrigation. There after polythene are covered and tightly packed with soil on one side and flat smooth stone on another side for easy cultural operation. Regular monitoring is done by the scientists throughout its growing period. With rise in temperature open the front and back during peak summer (June-July) during day time to avoid burning of crop. The yield data was collected from FLD plots of farmers.

Economics of Cultivation

The economics of the FLD is the most important consideration for making any recommendation to the farmers for its wide adoption. For calculating economics, the average

treatment yield along with prevailing market rates of the produce and cost of inputs were used. B: C ratio was computed by dividing gross returns with cost of cultivation for each treatment.

Cost of cultivation (Rs/ha)

The cost of the inputs that was prevailing at the time of their use was considered from sowing to harvest and to calculated per hectare.

Gross income (Rs)

The income was calculated based on the prevailing market price for the broccoli.

Net Income (Rs) The net income per hectare was calculated on the basis of gross income and cost of cultivation per hectare as follows.

Net income = Gross income – Cost of cultivation.

Benefit of Cost ratio: The benefit to cost ratio was worked out by using the following formula:

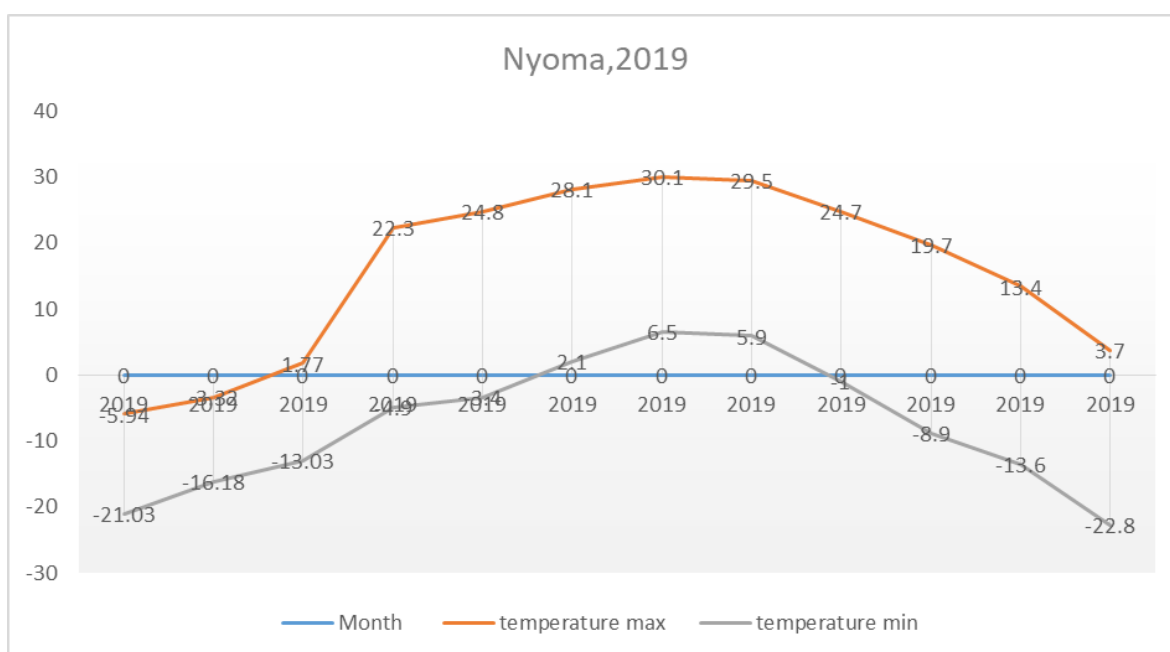
$$B:C = \frac{\text{Gross return}}{\text{Gross cost}}$$

Table 1: Geographic description of villages

S. No	Village	Locations	Altitude (m a MSL)
1.	Nyoma	N= 33°11.713 E= 078°37.109	4141
2.	Mudh	N= 33°12.179 E= 078°41.759	4260
3.	Tsaga	N= 33°12.083 E= 078°38.303	4344

Table 2: Economics of Broccoli under low tunnel in Nyoma (13800ft aMSL)

Particular	Demo yield q/ha	Cost of cultivation (Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C ratio
Broccoli var. Lucky	400	1193800	2280000	1086200	1.90
Broccoli var. Fiesta	350	1193800	2100000	906200	1.75



(Source: KVK-Nyoma)

Fig 1: Agroclimatic data in Nyoma (13800ft a MSL) under open conditions (2019)



Fig 2: Installation of low tunnel and performance of broccoli at 14300ft Amsl (Tsaga) in Changthang

Results and Discussion

The front line demonstration yield recorded in broccoli hybrid *Lucky* performing well in all aspects like in its germination percentage, quality produce and right head weight so it was recommended for farmer's at various locations. The yield recorded was 400qtl/ha as this crop are newly introduced to this region. Therefore, local check was not available. Like wise hybrid *Fiesta* also recorded 350 qtl /ha with slightly small head as compared to hybrid *Lucky*. Having the advantage of being pest free and of high nutritive value, cultivation of broccoli in succeeded immensely. The results of economic analysis (Table 2) of broccoli production revealed that cost of cultivation in demonstration practice (INR 1193800 /ha) from Installation of low tunnel, sowing to harvesting with high net returns of INR 1086200 /ha with high benefit cost ratio of 1:9 followed by hybrid *Fiesta* with benefit cost ratio of 1:75. This crop will be highly remunerative to farmers. Similar results was also obtained by Kumar *et al.* 2018 [3]. Therefore FLD programme is an effective tool for increasing the production and productivity of broccoli and changing the knowledge, attitude and skill of the farmers. This has not only resulted in socio-economic security but also helped in attaining food and nutrition security to the community. This crop will be the boon to this region and adoption of low tunnel technology is increasing due to its easy installation and low initial investment. In addition this will also suitable to small and marginal farming and subsequently increase the income as well as the livelihood of the farming community.

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