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Comparative Study on Cultivation of Cabbage Under Low Tunnel and Open Field Conditions in Cold Arid Ladakh Region

Tahir Saleem[1], Mohd Mehdi[2], A.H.Hakeem[1*], M.S. Trumboo[1] and N.A. Ganai[3]

Krishi Vigyan Kendra, Kargil -194103

Sher-e- Kashmir University of Agricultural Science and Technology, Kashmir (J&K)

ABSTRACT

The low tunnel technology increased seed germination from 75.3 to 91.0 per cent and seedling survival on transplanting from 76.3 to 96.6 per cent. Time taken for production of marketable seedling as well as attaining marketable cabbage heads reduced from 53 to 45.6 days and 85.3 to 75.3 days, respectively. Low tunnel cultivation advanced the growing of crop by around two months. The total cabbage yield was significantly higher under low tunnels as compared to open field conditions. Higher net returns per unit area were realized under low tunnel cultivation of cabbage than open cultivation due to early maturity, early market entry of produce and evading market glut.

Key Words: Low tunnel, Cold arid, Cabbage, Ladakh.

INTRODUCTION

With increased health awareness among general public vegetables are now becoming an integral part of average house hold's daily meals. In addition, high population growth rate, availability of packaged and air lifted fresh vegetable from distant markets has therefore generated a year round high demand for vegetable in this region. However, farmers have yet not been able to encash this opportunity and still follow traditional methods of production. This results in highly volatile vegetable supply in market wherein the market is flooded with seasonal vegetables irrespective of demand on one hand and extremely poor supplies and high priced vegetable during off season on the other hand.

Ladakh, the cold arid region of Jammu and Kashmir State experiences prolonged severe winters and has a short cropping season starting from last week of March to last week of September in double cropped areas and from first week of May to Last week of August in monocropped areas. Due to high altitude the intensity of solar radiation and long photoperiod (12 to 14 h) is good enough to support crop growth but the aridity and speedy wind dips temperature which limits growing of vegetable crops for large part of the year (Sharma, 2000). Plasticulture involves using plastic soil mulches and crop covers to improve microclimate conditions surrounding the crop, thereby enhancing earliness, improving yields and increasing profitability (Waterer, 2000).

For tapping the solar energy various types of forcing structures like green house, Ladakhi green house and trench have been successfully introduced but lack ready acceptability due to limitations in term of high initial costs, continuous power requirement, maintenance and replacement of soil after every 2-3 years for protection against soil borne disease and insect pest. Hence, a low cost and low maintenance technique, low tunnel technology was tried that ensures supply of vegetable during scarcity and help the grower to obtain reasonable and profitable return of their produce. By increasing air temperature, reducing wind damage and providing a degree of frost protection, the low tunnels accelerate crop production and extend the growing season

* Corresponding Author's email: pckvkbandipora@gmail.com
1. Krishi Vigyan Kendra SKUAST-K Bandipora, Potushai Bandipora, 193502
2. Krishi Vigyan Kendra SKUAST-K, Kargil -194103
3. Krishi Vigyan Kendra SKUAST-K, Kupwara.

(Waterer, 2003). In the present investigation, an on farm trial was conducted to compare the efficiency of low tunnel technology and traditional open field growing of cabbage hybrid S 92.

MATERIALS AND METHODS

On farm trials on cabbage hybrid S-92'Mitra' was conducted during the years 2006, 2007 and 2008 at 3 locations in the Kargil district. The supporting structure of low tunnel was made by using locally and abundantly available 2.5 m long, freshly cut willow sticks of 1.5 to 2 cm diameter. To obtain uniform curvature sticks were moulded by keeping them fixed in 0.5 m long strong pegs, nailed into ground at 5 different points along a prefixed curve, to obtain a diameter of 1m till the time these were dry and hard enough to provide sufficient support without losing the shape. After drying, arc shaped willow sticks were fixed at the proper site by inserting 15 cm deep into the soil at intervals of 75 cm to 90 cm, depending upon the diameter of the sticks. Seed for raising nursery were sown in the first week of February and transplanted in third week of March. The tunnel was covered with ordinary transparent polythene (2.4 m wide), with lateral supports and packed from all the sides. The polythene covering was removed gradually as the outside temperature became favorable for plant growth, starting with opening of tunnel at both ends followed by complete lifting during day time. The covering was removed completely after mid May. As dictated by weather, under open field conditions sowing and transplanting operations were possible only in the first week of April and third week of May, respectively. Observations on germination percentage, days taken to attain marketable seedlings, survival of transplants and percentage head formed plants were recorded. Harvesting of cabbage head was done by keeping unwrapped leaves intact with plant and allowing the plant to produce super heads. For calculating average head weight 30 randomly selected heads from each trial were weighed and yield per unit area was calculated by multiplying average head weight and number of head formed. Most of the new head sprouts were rubbed retaining a maximum of two heads per plant in order to obtain saleable heads. The yield of super heads was also recorded. The data were analyzed using the test of two independent means suggested by Herzberg (1983).

RESULTS AND DISCUSSION

Effect on seed germination and seedling survival

The seed germination percentage ranged from 87 to 96 per cent in low tunnel compared to 70 to 84 per cent under open field condition. This technology reduced days taken to reach the 3 to 4 leaf stage, which is considered fit for transplanting, from 53 to 45 days. Good moisture supply and protection from fluctuating temperature under low tunnel may be the cause of increased germination percentage and rapid growth. It is worth to note that the survival of seedlings after transplanting is very critical in Ladakh condition due to prevalence of dry weather and high speed desiccating winds. Under low tunnel structures, survival of seedlings after seven days was found to be superior (96.6 %) while as in open condition only 76.3 per cent seedlings survived. Flood irrigation immediately after transplanting might be the cause of reduced survival percentage in open field condition which

Table 1. Comparison of growth and yield of cabbage hybrid under low tunnel and open field conditions.

Character	Location -1		Location -2		Location -3		Average	
	Low tunnel	Open field	Low tunnel	Open field	Low tunnel	Open field	Low tunnel	Open field
Germination (%)	90	72	96	84	87	70	91*	75.3
Days to maturity of seedlings	46	52	48	54	46	51	46.6*	53.0
Transplantation survival (%)	98	81	98	75	94	73	96.6*	76.3
Days to head maturity	72	88	70	86	75	82	72.3*	85.3
No. of head formed plant (%)	96	91	98	90	95	88	96.3*	89.6
Average head weight (kg)	0.86	1.01	0.96	0.98	0.81	0.82	0.87	0.93
Yield (q/ha)	555.79	652.56	633.34	587.88	518.02	562.32	569.0	600.9
Yield of super heads (q/ha)	278.58	191.55	301.92	186.76	280.30	180.43	290.2*	186.2

Table 2. Economics of cabbage hybrid under low tunnel and open field conditions.

Location	Yield of main crop (q/ha)	Return (Rs./ha)	Yield of super heads (q/ha)	Return (Rs./ha)	Gross income (Rs./ha) (3+5)	Cost of input (Rs./ha)	Net profit (Rs/ha)
1	2	3	4	5	6	7	8
Low tunnel	569.05	6,82,860	290.26	2,32,208	9,15,068	95,200	8,20,008
Open field condition	600.92	4,80,736	186.24	1,48,992	6,29,728	-	6,29,728
% increase over open field		42.2		55.82			30.21

- Cost of input includes only cost of polythene and willow sticks keeping a life span of 1 and 3 years respectively.
- Sale rate of main crop under low tunnel (off season) Rs.12/kg and rest @ Rs. 8/kg

most of the time becomes necessary due to high evaporation rate coupled with porous soils. To keep the soil moist, in open planting, manual fountain bucket watering, 2-3 time a day is required, which is laborious and adds to the cost of cultivation while in low tunnel single manual fountain bucket watering is quite sufficient for three to four days, which meets the requirement because of drastically reduced rate of evaporation and recycling of the evaporated moisture. Improved microclimate resulted in early maturation coupled with increased proportion of head formed plant in low tunnels (Table 1).

Effect on yield and maturity

The average head weight was more in open field because of the high light intensity, which increase the rate of photosynthesis (Jain, 2005) but was not able to compensate the yield difference. The early maturation of heads under low tunnel provided sufficient time to gain size and firmness of super heads which resulted in 55.8 per cent increase in yield of super heads over open field grown cabbage.

Under low tunnel the heads were ready for harvest in the first fortnight of June and reaped the early market high price (Rs. 10 to Rs.14/kg.) as at this point of time only distant produced vegetables are available in the market. Further due to nuclear family system the demand of super heads which weigh about 200-400g was preferred, purely for economic reasons, as open field grown big sized cabbage heads weighing around two kg are only available in the market during this period and not required by small families. Early maturation of main crop and small compact super heads produced under low tunnel not only protected grower from market glut but also raised net profits, to as high as Rs. 8,20,008/ha against Rs. 6,29,728 /ha earned from the crop grown in open field condition.

CONCLUSION

The low tunnel technology is a suitable technology for the region, which is low cost than other forcing structures, has potential to increase the per unit area returns and can play a positive role in nutrition by making vegetable available in the off-season. The technology needs testing for other crops as well.

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