

Protected Cultivation of Medicinal Plant in Composite Climate of Indian State Rajasthan

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Abstract: Adoption of greenhouse technology can improve yield and productivity of medicinal crop in off season cultivation. The study was conducted with two medicinal crops viz: *Withania somnifera* and *Psoralea corylifolia* to evaluate cultivation performance and compare with field condition. The experimental results shows that mean plant height of *Withania somnifera* and *Psoralea corylifolia* in greenhouse condition was 78.9 cm and 125 cm whereas it was 2802 cm and 50 cm in field condition respectively. The collar diameter for *withania somnifera* was 9.8 mm and 5.68 mm for greenhouse and field condition respectively. The collar diameter for *psoralea corylifolia*, it was 10.8 mm in greenhouse and 5.96 mm for field condition was recorded. Total dry matter from *Withania somnifera* and *Psoralea corylifolia* inside the greenhouse was 92.9 g per plant and 118.7 g per plant whereas it was 25.8 g per plant and 40.3 g per plant at field conditions. The above experimental results shows that off season cultivation of medicinal plants under greenhouse condition will increase the production of these high value medicinal plants and permit round year production of these crops.

Key word: Biometric observation • Cultivation • Greenhouse • Medicinal crop

INTRODUCTION

Protected cultivation techniques are widely used for crop production under controlled / partially controlled environment in temperate region and even in arid climates on a commercial basis. They can play vital role in developing country like India for increasing agricultural production and productivity. Water scarcity, high temperature and low humidity are the prevalent condition during summer (April – June) in India. These conditions make plant production quite difficult. Plastic films made of low-density polyethylene (LDPE) are commonly used in agriculture as coverings for greenhouse or low tunnel and for soil mulching in order to increase the yield and quality of agricultural products. The purpose of the greenhouse plastic covering is, in addition to protection of the plants from atmospheric agents, to increase the greenhouse internal air temperature, thus lengthening the market availability of the products. The plastic films used for soil mulching reduce water and pesticide consumption, soil-borne pathogens and protect the cultivation area against erosion; black mulching films reduce the growth of weeds [1-3].

The aim of the present research was to evaluate the performance of greenhouse to cultivate the medicinal crops viz. *Withania somnifera* and *Psoralea corylifolia* were selected to cultivate in both greenhouse and open field conditions.

Withania somnifera contains withaniols and several other alkaloids. Root and some to some extent leaves and seeds are used in Ayurvedic and unani medicines. Roots are used for hiccup, bronchitis, rheumatism, dropsy, several female disorders, stomach and skin diseases. *Psoralea corylifolia* is extensively used in indigenous system of medicines for curing lecoderma, leprosy and psoriasis. The only pericarp of the seed contains important communication compounds like psoralen and isopsoralen. It has antimicrobial, anti feedent and insecticidal activities also.

EXPERIMENTAL STUDIES

Field experiment was conducted in greenhouse and open conditions during 1st January 2001 to 10th June 2001 to assess the growth response of *withania somnifera* and *Psoralea corylifera* in term of germination period,



Plate 1: Front view of greenhouse with cooler



Plate 2: Greenhouse with exhaust fan

germination and survival per cent, plant height, collar diameter and dry matter content. To achieve the above objective different component of the study i.e. environment and growth related factors were studied and evaluated by adopting standard procedures.

Experimental Site: The experiment was conducted in summer season (January to June in India) in the plastic greenhouse at Instructional farm of College of Technology and Engineering, Udaipur (24°35' N, 73°42' E), Rajasthan.

Detail of the Greenhouse under Study: A semi circular shaped greenhouse covering a floor area 4m x 10 m (40 sq. m.) comprising desert cooler and exhaust fan was used for study as illustrated by Plate 1 and 2. The orientation of greenhouse is in east west direction. The greenhouse is covered with ultra violet stabilized low density polyethylene sheet having 200 μ m thickness.

Biometric Observation: The various biometric observations were recorded on five randomly selected plants of the selected crop. These plants were suitably tagged for their identification. The emergence of plants as

well as maximum germination was recorded daily. The germination percentage was recorded 40th day after sowing. The height of plants was recorded by measuring the length of shoot from the soil surface level of plants upto the top of the completely open leaf at an interval of 7 days. The collar diameter of plants were recorded by measuring the collar diameter of same plants whose height were measured at an interval of 7 days. Shoot and root weight are the most commonly used parameter studies of the plant growth in response to environment. To determine the dry weight, the washed and clean root and shoot part of plant were put in solar dryer. The observation of weighing of samples was taken after every 24 hours till they attained the constant weight. The survival per cent was recorded by counting the plants at the end of experiments.

RESULT AND DISCUSSION

Plant Height of Aswagandha (*Wethania somnifera*):

The mean plants height increase progressively with the increase in age of sowing till the period of study. The plant growth rate, measured in terms of plant height. There was a steep rise in the height of plants grown inside the greenhouse. After 64 days there was a steep rise in the height of plants grown inside the greenhouse. It may be easily seen from the Fig. 1 that there was a mere difference in the plant height in outside as well as greenhouse conditions.

The mean plants height in open conditions was found as 28.2 cm while it was 78.9 cm in greenhouse conditions. Thus there was about 50.7 cm (179.78 percent) increase of plants height inside the greenhouse over the outside. This increase in height may be attributed to the partially controlled environment i.e. maximum relative humidity was almost in the range of 80 to 93 percent and soil and air temperature in the range of 12 to 32 °C during the day time except at noon hours. This might have contributed to the height photosynthetic efficiency inside the greenhouse than outside condition.

Plant Height of Babchi (*Psocalea corylifolia*): The maximum plant height of 110 days old plants 125 cm in greenhouse condition whereas 50 cm in outside condition. It was 75 cm (150 percent) more height was observed in greenhouse conditions. From the Fig.2 we get the idea of increase in plants height after sowing as the number of days proceeds. After 57 days of sowing the seeds of *Psoralea Corylifolia* the plants height inside the greenhouse increased steeply over the outside condition.

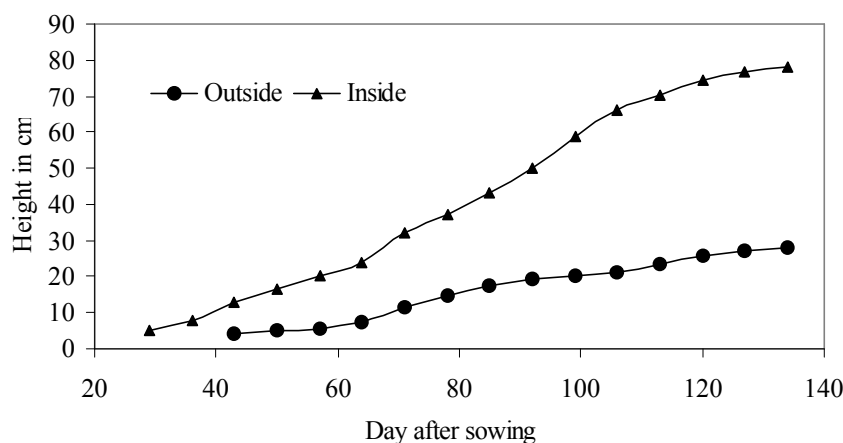


Fig. 1: Plant height of Aswagandha

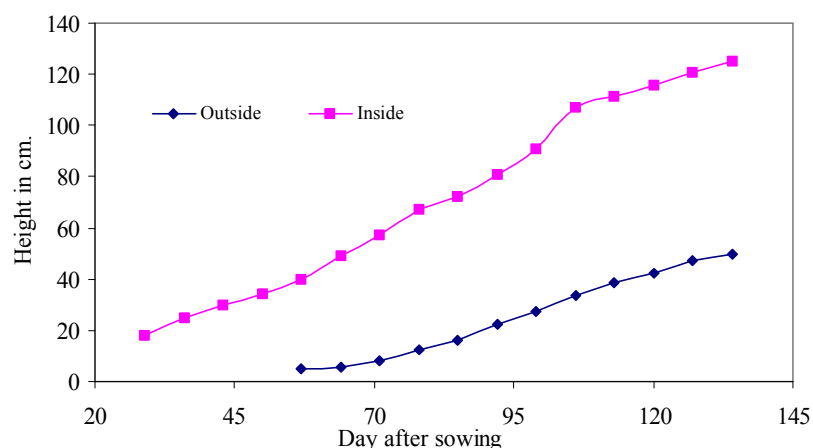


Fig. 2: Plant height of Babchi

Thus it may conclude that cultivation of *Psoralea corylifolia* in greenhouse conditions was far better than outside conditions. This increase in height may be due to the availability of desired relative humidity throughout the day, soil and air temperature in most of the daytime.

Plant Collar Diameter Aswagandha (*Withania somnifera*): The growth rate of *Withania somnifera* is shown in Fig. 3 for both outside and inside greenhouse conditions. The growth rate in plants collar diameter was faster inside the greenhouse after the 36 days of sowing. But the number of days after sowing preceded the plants inside the greenhouse was influenced by the microclimate inside the greenhouse and hence the substantial faster growth rate is observed inside the greenhouse as compared to the plants grown in outside conditions. The collar diameter of 110 days plants was observed as shown in Fig.3 The maximum collar

diameter 9.8 mm inside the greenhouse and 5.68 mm outside was observed and it was increased by 72.52 percent.

It may be concluded that the plant collar diameter is the least variable parameter and there was no significant difference between the tree species with regard to this parameters.

Plant Collar Diameter of Babchi (*Psoralea corylifolia*): The plant collar diameter is graphically presented in Fig. 4. From Figure the wide variation were observed in plant collar diameter grown inside the greenhouse conditions. The plant collar diameter was increased steeply inside the greenhouse as compared to the open conditions. The 110 days old plant of *Psoralea corylifolia* was 5.96 mm in outside conditions and 9.88 mm in greenhouse conditions. The main increase in plant collar diameter in greenhouse over outside condition was 65.77 percentages was observed.

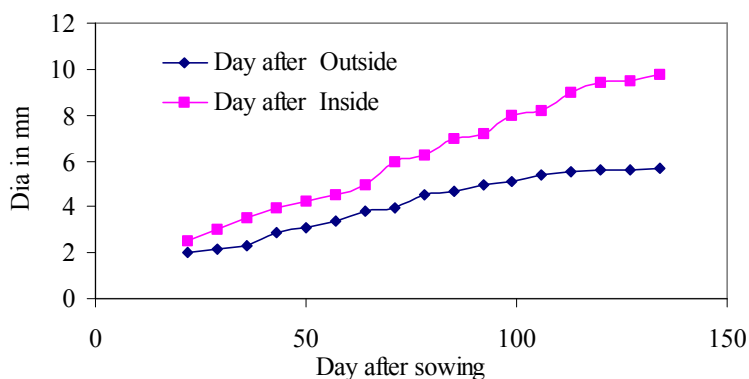


Fig. 3: Collar diameter of Aswagandha

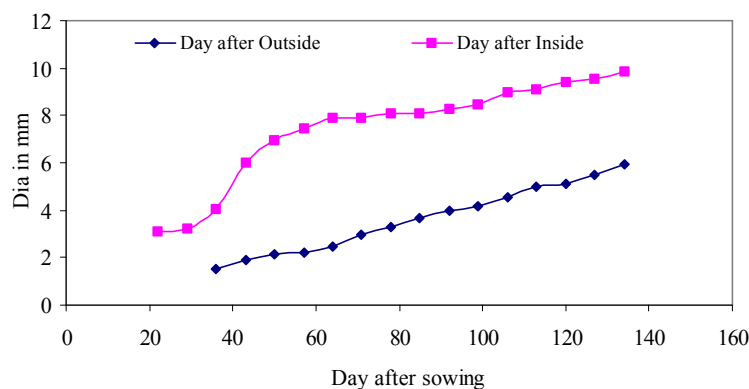


Fig. 4: Collar diameter of Babchi

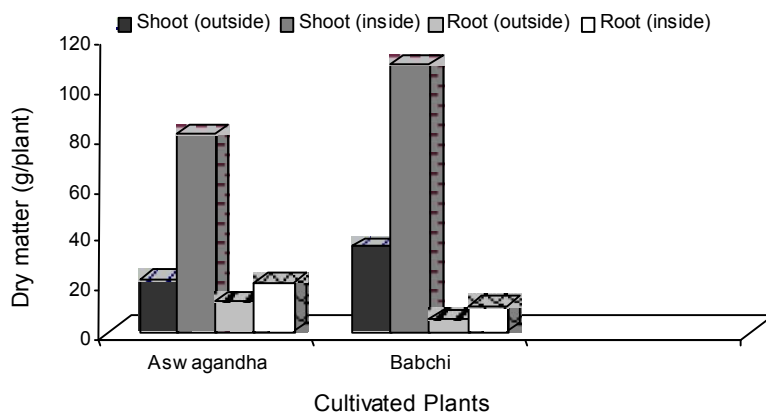


Fig. 5: Biomass from cultivated plants

Biomass Yield of Aswagandha (*Withania somnifera*):

Fig.5 shows the dry matters content of shoot and root part of the plant. The maximum shoot and root weight of plant was found as 21.5 g and 12.4 g/plant in outside conditions, while they were 80.7 g and 20.2 g/plant in greenhouse condition. Substantial difference is observed between the seedling dry matter in open and greenhouse condition. In 110-day-old plants the dry matter of shoot part of plants in greenhouse over open condition was

increased by 59.2 g per plant while the dry matter of the root part was increase by 7.8 g per plants. Thus it may be concluded that the dry matter of shoot and root part of the plants Aswagandha (*Withania somnifera*) was increased more than one time in greenhouse conditions when grown during 4th to 23rd standard weeks. Total dry matter (shoot + root) in 110 days old plants was 33.9 and 100.9 g per plants in open and greenhouse conditions.

Table 1: Data on Germination and Survival Plants Species under Greenhouse and Outside Conditions

Particulars	Outside	Inside
Number of days required for emergence		
Aswagandha (<i>Withania somnifera</i>)	16	13
Babchi (<i>Psoralea corylifolia</i>)	11	7
Number of days required for maximum germination		
Aswagandha (<i>Withania somnifera</i>)	25	39
Babchi (<i>Psoralea corylifolia</i>)	18	28
Germination percentage		
Aswagandha (<i>Withania somnifera</i>)	45	48
Babchi (<i>Psoralea corylifolia</i>)	71	73
Survival percentage		
Aswagandha (<i>Withania somnifera</i>)	54	60
Babchi (<i>Psoralea corylifolia</i>)	96	98

Biomass Yield of Babchi (*Psoralea corylifolia*):

The dry matter content in shoot and root part of 110 days plants is graphically shown in Fig.5. The dry matter content in shoot part of the plant was 35.1 g per plant in outside condition and 108.9 in greenhouse conditions. In root part of plants in regard to dry matter was found 5.3 g per plant in outside conditions and 10.7 g per plants in greenhouse conditions. Highly difference was observed in the dry matter content of shoot and root part of the *Psoralea corylifolia* in open and greenhouse condition. There was 207.69 per cent increase in shoot part and 107 percentage increases in root part of the plant dry matter inside greenhouse over outside conditions. The total dry matter (shoot and root) in 110 days old plants was 40.3 g and 118.7 g per plant in outside and greenhouse conditions respectively.

Yield of Seeds: The yield Aswagandha inside the greenhouse was 3.14 kg per sq m whereas this value for outside was observed as 1.59 kg per sq m. The yield of Babchi was inside the greenhouse 9 kg per sq m whereas this value for outside was obtained 2.59 kg per sq m. The similar trend were reported by Sharma *et al.* [4] for cultivation of strawberry

Germination and Survival of Aswagandha (*Withania somnifera*): It can be seen from Table 1 that 5-day early germination start in green house. The time required for maximum germination is 18 days for inside the greenhouse and 25 days for open condition. The germination percentage of this crop was 71 and 45 for inside and outside greenhouse respectively. This crop survives very well inside the greenhouse having value 96% for inside and 54% for outside the greenhouse.

Germination and Survival of Babchi (*Psoralea corylifolia*): It can be seen from Table 1 that it was first crop among three which grow early in greenhouse. Inside greenhouse germination start from 7 days after sowing

and after 28th day no germination was found. 6-day later germination starts outside the greenhouse and after 39th day no germination was found. Hence this crop takes more time to germinate outside the greenhouse. Its survival percentage was 98 and 60 per cent inside and outside the greenhouse.

CONCLUSION

- The excellent height was measured under greenhouse it may be due to microclimatic measure.
- During study it was observed that the outside the greenhouse maximum germination occurred upto 35 days after sowing.
- High yield for both *withania somnifera* and *psoralea corylifolia* were recorded inside the greenhouse.

It is recommended that construction of greenhouse should be encouraged for growing high value crops and particularly those crops which can give good return to farmers but can't grow outside the greenhouse because of non-congenial environmental condition.

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