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# Effect of time of planting and spacing on growth and yield of Sarpgandha in Jharkhand, India

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## ABSTRACT

*The plants of* Rauvolfia serpentina *were transplanted in the experimental field (D-Block) of Birsa Agricultural University, Ranchi in Factorial RBD with three times of transplantation, viz., mid-May, mid-June, and mid-July at spacing of 40×30 cm, 50×40 cm, and 50×50 cm with 5 replications. The roots of Sarpgandha are an important part of the plant, which is used for medicinal purposes, mainly used to control high blood pressure. As long time, its roots used to treat mental illness and snakebite, commonly known as "Pagal ki buti" or "insanity herb". Planting time and spacing influence the growth as well as the yield of the crop. The aim of this paper was to find out the optimum spacing and real time of plantation for obtaining maximum yield. The maximum productivity of Sarpgandha roots and the optimum time of transplantation of seedlings is mid-May at a 40 cm × 50 cm spacing level.*

**Key words:** Sarpgandha, Spacing, Time, Treatment and Transplantation

## INTRODUCTION

*Rauwolfia serpentina* (L.) Benth. Ex Kurz. is a small, woody shrub that belongs to the Apocynaceae family. It is commonly called Sarpgandha, which grows in the region with an annual rainfall of 200 to 250 cm at 1000 m altitude. It is one of the most commercially viable indigenous medicinal plants in Southeast Asian countries. The plant is used in the treatment of insanity and snakebite. The alkaloid reserpine from the root extract is used to treat high blood pressure and mental disorder (Isharwal and Gupta, 2006). The deep, fertile soil with rich organic matter is favourable for the growth of this plant. The major causes of the decline of this plant species from the natural habitat are poor rates of seed germination, overexploitation, and habitat loss.

India is the most important country in the field of medicine production. It ranks 10th in the world and 4th in Asia, having 15 to 20 thousand plant species with medicinal value, of which 30% are considered endemic to India. Currently, there are around 880 species of medicinal plants in all of India's trade (Praveen Kumar *et al.,* 2007). About 90% of them are collected from wild sources (forest), and a minority is sustainably produced and harvested through cultivation. Furthermore, 70% of such collection involves destructive harvesting, wherein roots, barks, twigs, flowers, leaves, fruits, seeds, and whole plants (in the case of herbs) are collected for use in herbal drugs (Suman and Khanuja, 2006). Due to over-destructive exploitation of many rare medicinal plant species like Sarpgandha, they are on the verge of extinction. For conservation of such a medicinal plant, it should be cultivated in the cultivated field. Twenty-nine medicinal plants are already banned for export (Pandey and Mandal, 2007). For scientific cultivation of Sarpgandha as a medicinal crop, agro techniques like time of planting and spacing are necessary to develop systematic cultivation practices in India. There is an urgent need to develop production practices for the cultivation of Sarpgandha, which is the most important medicinal crop plant of India. The objective of this paper is to find out the optimum spacing and real time of plantation for obtaining maximum yield in the agroclimatic zone of Jharkhand (India).

## MATERIALS AND METHODS

The experiment was conducted in the experimental plot (D-Block) at Birsa Agricultural University, Kanke, Ranchi, Jharkhand, India. The soil is reddish loamy, and the temperature ranges from 20°C to 42°C during the summer and from 0°C to 25°C during the winter. The

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annual rainfall is approximately 1430 mm. The plants of *Rauvolfia serpentina* were transplanted in experimental field in Factorial RBD with three times of transplantation viz. mid-May, mid-June and mid-July at spacing of 40×30 cm, 50×40 cm and 50×50 cm with 5 replications.

## RESULTS AND DISCUSSION

Mass scale cultivation of Sarpagandha depends on various factors like soil, climate, altitude, rainfall and other conditions. Time of planting and spacing also plays important role in rapid growth and yield of Sarpgandha. Sarpgandha crop is a common medicinal plant that is cultivated in India. Cultivation of Sarpgandha in India was reported by many authors (Biswas, 1956; Dutta *et al.,* 1963). Methods of propagation, cultivation and their effect on root production were reported by Badhwar *et al.,* (1956). The maximum plant height (70.72 cm) was observed in the treatment combination of mid-July transplantation and spacing levels of 50 cm × 50 cm. Wider spacing between plants allows each plant to access resources more effectively, reducing the competition for essentials like soil nutrients, moisture, carbon dioxide, and light. This can result in healthier, more vigorous growth, as each plant has more space to spread its roots and leaves (Somveer and Santosh, 2024). The Ministry of Health & Family Welfare Regional Research Laboratory (1942) reported that the maximum height of the Sarpgandha plant is up to 60 cm. Billore *et al.,* (2005) mentioned that it is an erect, evergreen perennial shrub with a long, irregular, nodular, yellowish rootstock, growing to a height of 60-90 cm. Maximum stem collar diameter (9.02 mm) was recorded in the treatment combination of mid-May transplantation at spacing levels of 40 cm × 50 cm. Maximum net seed yield/plant (30.94 kg/ha) was observed in the treatment combination of mid-May transplantation and spacing levels of 30 cm × 40 cm as shown in Table 1. Interaction between the time of transplantation and different spacing levels in all the above three parameters was non-significant.

Table 1: Recoded the maximum values of different parameters with respect to space and time of transplantation

| Parameters | Recorded maximum value | Time of transplantation (T) | Spacing (S) | Significance level between (T x S) |
|---|---|---|---|---|
| Plant height | 70.72cm* | Mid-July | 50 cm × 50 cm | Non-significant |
| Collar diameter | 9.02 mm* | Mid-May | 40 cm × 50 cm | Non-significant |
| Leaf length | 8.94 cm* | Mid-July | 30 cm × 40 cm | Significant |
| Leaf breadth | 3.93 cm* | Mid-July | 30 cm × 40 cm | Significant |
| No. of primary branches/plant | 12.16* | Mid-June | 50 cm × 50 cm | Significant |
| No. of leaves/plant | 94.72* | Mid-July | 50 cm × 50 cm | Non-significant |
| No. of nodes/plant | 25.64* | Mid-July | 50 cm × 50 cm | Non-significant |
| Length of internodes | 2.70 cm* | Mid-May | 40 cm × 50 cm | Significant |
| Crown spread (EW) | 25.24 cm* | Mid-May | 40 cm × 50 cm | Significant |
| Crown spread (NS) | 23.04 cm* | Mid-May | 50 cm × 50 cm | Non-significant |
| No. of fruits/plant | 8.23* | Mid-June | 40 cm × 50 cm | Non-significant |
| No. of seeds/plant | 13.86* | Mid-June | 40 cm × 50 cm | Non-significant |
| Length of seed | 6.88 mm | Mid-June | 50 cm × 50 cm | Non-significant |
| Breadth of seed | 5.20 mm* | Mid-June | 30 cm × 40 cm | Significant |
| 100 seed weight | 4.69 g* | Mid-June | 40 cm × 50 cm | Non-significant |
| Yield of seeds/plant | 0.65 g* | Mid-June | 40 cm × 50 cm | Non-significant |
| Net seed yield/ha | 30.94Kg* | Mid-May | 30 cm × 40 cm | Non-significant |
| % of single seeded fruits/plant | 33.36%* | Mid-June | 30 cm × 40 cm | Non-significant |
| % of double seeded fruits/plant | 69.83%* | Mid-July | 50 cm × 50 cm | Non-significant |
| Survival % | 98.33% | Mid-June<br>Mid-July | 50 cm × 50 cm<br>30 cm × 40 cm | Non-significant |

After 12 months of transplanting, the maximum leaf length (8.94 cm) and breadth (3.93 cm) were recorded in the treatment combination of mid-July transplantation and spacing levels at 30 cm × 40 cm. Interaction between the time of transplantation and

different spacing levels was significant. The maximum number of leaves/plant (94.72) and number of nodes/plant (25.64) were recorded in the treatment combination of mid-July transplantation and spacing levels at 50 cm × 50 cm. Abera *et al.,* (2008) reported number of leaves per plant is directly proportional to plant growth, After 15 months of transplanting, the maximum number of fruits/plant (8.23), number of seeds/plant (13.86), 100 seeds weight (4.69 grams), and seeds yield/plant (0.65 grams) were observed in the treatment combination of mid-June transplantation and spacing levels at 40 cm × 50 cm, and their interaction between the time of transplantation and different spacing levels was non-significant. Maximum survival percentage (98.33%) was observed in two treatment combinations of mid-June and mid-July transplantation and spacing levels at 50 cm × 50 cm and 30 cm x 40 cm, respectively.

**Fresh root weight/plant (g) of Sarpgandha**

Rauvolfia root has a long history of medicinal use in India, especially as a treatment for various conditions related to the central nervous system. Kirtikar and Basu (1993) mention its use in traditional medicine for a range of issues, including high blood pressure, insomnia, anxiety, and even more severe conditions like schizophrenia and epilepsy. As per the Table 2, the maximum fresh root weight (163.20 g) was observed when the plants were transplanted in mid-May with a spacing of 40 cm x 50 cm. The minimum fresh root weight (107.28 g) was recorded when transplanted in mid-June with a spacing of 30 cm x 40 cm**.** This suggests that both the timing of transplantation and the spacing between plants significantly influence root growth. Transplanting in mid-May and using wider spacing (40 cm x 50 cm) seem to provide optimal conditions for root growth. Raveena *et al.,* (2022) observed an interesting relationship in cucumber between planting geometry and fruit yield. The study indicates that closer spacing (60 cm x 30 cm) led to significantly higher fruit yield (1024.02 kg/100 m²), while wider spacing (75 cm x 30 cm) resulted in the lowest yield (932.6 kg/100 m²).

The total yield of roots in the case of plants raised from seeds is about 1175 kg/ha on an air-dried basis as compared to 175 kg/ha in the case of plants raised from stem cuttings and 345 kg/ha in the case of root cuttings. Under irrigated conditions, dry root yield varies from 15 to 25 q/ha. According to estimates, 400-500 tons of roots are being collected annually, mostly from forests in India, Bangladesh, Sri Lanka, and Thailand (Poonam and Mishra, 2013).

Table 2: Fresh root weight/plant (g) of Sarpgandha at 18 months

| Spacing levels | Time of transplantation | | | Mean |
|---|---|---|---|---|
| | Mid May ($T_1$) | Mid June ($T_2$) | Mid July ($T_{13}$) | |
| 30 cm × 40 cm ($S_1$) | 142.67 | 107.28 | 109.48 | 119.81 |
| 40 cm × 50 cm ($S_2$) | 163.20 | 125.37 | 116.91 | 135.16* |
| 50 cm × 50 cm ($S_3$) | 124.00 | 113.20 | 111.92 | 116.37 |
| Mean | 143.29* | 115.28 | 112.77 | Grand mean – 123.78 |
| | $S.E._{(M)}$– 3.55 | $C.D._{(5\%)}$ - 10.22 | $C.V._{(5\%)}$– 11.11 | Significant |
| | $Interaction_{(TxS)}$ - Non - significant | | | |

**CONCLUSION**

From the above results, it can be concluded that the maximum productivity of Sarpgandha roots have obtained in the treatment combination of time of transplantation of seedlings is mid-May at a 40 cm × 50 cm spacing level. The mid-May transplantation and the wider spacing (40 cm x 50 cm) are important for better root growth. Hence, the ideal time for transplantation of sarpgandha seedlings is mid-May and spacing level 40 cm × 50 cm for the cultivation of Sarpgandha medicinal crop in the agroclimatic zone of Jharkhand (India).

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