

Changes in environmental conditions influence the growth, yield, and quality attributes of ashwagandha (*Withania somnifera*) cultivars

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Ashwagandha (*Withania somnifera* L. Dunal) is an important medicinal plant belonging to the family Solanaceae with significant pharmacological and economic value due to its increasing demand in nutraceutical and pharmaceutical industries. A field experiment was conducted at the research farm of CSIR-Central Institute of Medicinal and Aromatic Plants (CSIR-CIMAP), Lucknow, for two consecutive years (2021–22 and 2022–23) to optimise plant population and harvesting stages of two cultivars (NMITLI-118 and NMITLI-101) under summer and winter seasons for maximising yield and quality. The results showed significant effects of cultivars (C), plant population (P), harvesting stage (H), and their interactions (C × P × H). The treatment combination C1 × P2 × H2 recorded maximum dry leaf (2.04 t/ha), root (1.74 t/ha), and seed yields (0.67 t/ha). The summer-grown crop harvested at full flowering stage (120 DAS) exhibited superior growth, photosynthetic activity, and quality traits, including withanolide content (0.68%), starch (23.7%), and crude fibre (41.22%). Higher economic returns were obtained with 20 × 15 cm spacing in cv. NMITLI-118 during summer. Overall, optimised agronomic practices and suitable cultivars significantly enhance the yield, quality, and profitability of ashwagandha cultivation. Adopting suitable ashwagandha cultivars and optimised agronomic practices can enhance yield and quality, thereby meeting pharmaceutical demand and improving farmers' incomes.

Keywords: Ashwagandha, Cultivars, Growth attributes, Harvest stage, Plant density, Seasonal variation, Withanolides, Yield

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