

Response of Foliar Application of Growth Hormone and Nutrients on Plant Growth and Seed Yield in Carribbean Stylo *Stylosanthes hamata*

R.K. BHATT¹, R.K. TRIPATHI AND H.S. TIWARI

Seed Technology Division, Indian Grassland and Fodder Research Institute, Jhansi 284 003
researcher_rkb@yahoo.com

ABSTRACT The shoot growth in terms of plant height increased by foliar application of growth hormone and nutrients in carribbean stylo *Stylosanthes hamata*. It was maximum by the application of NAA (100 ppm), whereas it decreased by the foliar application of cycocel (0.5 kg/ha). Rate of photosynthesis and stomatal conductance increased significantly by foliar spray of chemicals. Rate of photosynthesis significantly improved in the plants treated with GA₃ (100 ppm) and NAA (100 ppm), followed by KNO₃ (4 kg/ha), whereas the responses of boron (100 ppm) and cycocel (0.5 kg/ha) were at par. Maximum transpiration rate was recorded in the plants sprayed with NAA (100 ppm) and KNO₃ (4 kg/ha). The flower production increased in plants with foliar spray of GA₃ (100 ppm), followed by KNO₃ (4 kg/ha), whereas NAA (100 ppm) and boron (100 ppm) application were at par. Maximum seed yield (232.85 kg/ha) in the plants treated with GA₃ (100 ppm) and 221.54 kg/ha was recorded in plants treated with KNO₃ (4 kg/ha) over the control (173.46 kg/ha). The seed yield increased by 3.5-34 per cent. The increase in seed yield might be due to increase in the number of flowers/plant as indicated by positive and significant correlation between these two parameters ($r=0.9663$). Maximum seed test weight (3.30 g) was recorded by the application of KNO₃ (4kg/ha), followed by 3.24 g GA₃ (100 ppm) over the control.

Key words: Growth hormone, flowering, seed yield, seed test weight, *Stylosanthes hamata*

Stylosanthes is an important pasture legume grown in tropical and subtropical environments. Its introduction during sixties, has gained a prominence in rangeland development programme in India. It is extensively used in pastoral, agro-pastoral and silvipastoral systems to restore soil fertility, improve physical properties and to provide a permanent cover. It is playing a vital role in the development of wasteland in the country. Five species, viz. *S. guianensis*, *S. hamata*, *S. humilis*, *S. scabra* and *S. viscosa* have been reported [1]. Of these, *S. hamata* is preferred owing to adaptive to wide ecological amplitude. In general seed production in *S. hamata* is low due to its genetic limitations in seed setting, non-synchronous flowering, abscission of flowering, pod filling, seed dropping and physiological drift during seed development.

Foliar nutrient sprays have been found beneficial, since it is readily absorbed and not lost and it is in the root fixation, erosion and leaching [2]. Plant hormones and inorganic nutrients share common physiological functions and influence the growth and development of plants. Application of nutrients, growth hormones and retardants has been worked out in this study to increase yield attribute and improve seed quality in *S. hamata*.

MATERIALS AND METHODS

The scarified seeds of *S. hamata* were sown in rows (25 cm distance; plot size 4 m x 4 m) in replicated RBD at Farm of Indian Grassland and Fodder Research Institute, Jhansi (25.27° N, 75.35° E and at altitude of 275 msl). Basal dose of N: 20 kg/ha and P₂O₅: 40 kg/ha were applied, and the crop was raised as per the recommended

¹Head of Division, CAZRI, Jodhpur 342 003

agronomic practices. Treatments (T_1 : Control, T_2 : Gibberellic acid (GA_3 , 100 ppm), T_3 : Naphthalene Acetic Acid (NAA, 100 ppm), T_4 : KNO_3 (4 kg/ha), T_5 : Boron (100 ppm), T_6 : Cycocel (0.5 kg/ha) were used as foliar spray at vegetative stage (45 DFS) and flowering (80 DFS) during crop growth. Control plot was sprayed with water. The plant height and number of branches were recorded at 50 per cent flowering.

The photosynthesis rates (PN), stomatal conductance (CS) and transpiration rate (TR) were recorded in leaves by using portable photosynthesis system (LI-COR, USA) between 11.00 and 12.00 hr (on clear day). To record seed yield, the crop was harvested at maturity in second week of November. After plot wise harvesting, seed was threshed and properly cleaned. The 1000-seed weight (without scarification) was recorded on uniform size and coloured seeds.

RESULTS AND DISCUSSION

The pooled data of three years as mean values are presented in Table 1. Maximum plant height (43.25 cm) for NAA and minimum (31.22 cm) for cycocel (0.5 kg/ha) treatments were recorded. The response to GA_3 , KNO_3 and boron were non-effective as in the control. The mean plant height increased by 8.5 per cent over the control by the foliar application of NAA, whereas it decreased by 13 per cent by the application of cycocel. Increase in plant height with the application of NAA (100 ppm) was reported [3] in wheat.

The cell division and cell elongation might be influenced by the chemical [4]. The increase in shoot growth occurred due to higher photosynthetic activity and accumulation of photosynthates, as evident from the positive and significant correlation of shoot growth with PN ($r = 0.6257$). The number of branches/plant also increased (over the control) in all treatments. Maximum number of branches (13.18) was recorded in the plants treated with NAA, followed by (13.12) GA_3 , whereas the response to KNO_3 and boron was at par. The higher branch number might be due to either the effect of growth hormone on cell division [5] or more accumulation of biomass and its partitioning to

branch formation.

Rate of photosynthesis increased significantly in all the treatments over the control during all three years (Table 1). Maximum rate of photosynthesis ($28.26 \mu \text{mole/m}^2/\text{s}$) was recorded in the treated plants with GA_3 , followed by 28.25, $27.39 \mu \text{mole/m}^2/\text{s}$ in NAA and KNO_3 treated plants, respectively. The response to boron and cycocel treatment was at par. Higher rate of transpiration ($13.99 \text{ m mole/m}^2/\text{s}$) was recorded in the plants treated with NAA, followed by KNO_3 ($13.72 \text{ m mole/m}^2/\text{s}$).

The flower production in all three years increased significantly with the foliar spray application (Fig. 1). Maximum number of flowers was recorded in plants treated with GA_3 , the response to NAA, KNO_3 and boron were at par. The GA_3 induced flower initiation in many long day plants [6]. Flower production and synchronization significantly improved by the chemical application. The seed and vegetative yield were significantly affected by the foliar application of growth hormones, nutrients and growth retardants as data presented in Table 1. Average seed yield ranged from 173.46 kg/ha to 232.85 kg/ha. Maximum seed yield was recorded in the plants treated with GA_3 (232.85 kg/ha), followed by KNO_3 (221.54 kg/ha).

The increase in seed yield might be due to increase in number of flowers per plant as indicated by the positive and significant correlation between these two parameters ($r=0.9663$). The rate of photosynthesis has direct relation with the seed yield ($r= 0.6530$) (Fig. 2). The increase in seed production by foliar application of chemicals might have increased the sink capacity and improved the source-sink relation through which translocation of photosynthates to the sink had enhanced.

Leonard *et al.* [7] had reported that growth hormones improve cell division which affects photosynthesis at early stage of development. This increase in seed yield was directly associated with the increase in 1000-seed weight as evident by the linear relationship (Fig. 3). The seed quality in term of seed test weight also improved by the foliar application of these chemicals. The

Table 1. Response of foliar spray of growth hormones and nutrients on growth and seed yield in *Stylosanthes hamata* (average data of three years)

Treatment	Plant height (cm)	Branches/plant	Rate of photosynthesis (m mole/m ² /s)	Rate of transpiration (m mole/m ² /s)	Stomatal conductance (cm ² /s)	Seed yield (kg/ha)	1000-seed weight(g)
GA ₃ (100ppm)	38.61	13.12	28.26	12.15	2.197	232.85	3.24
NAA (100 ppm)	43.25	13.18	28.25	13.99	2.400	209.67	3.15
KNO ₃ (4 kg/ha)	38.55	12.65	27.39	13.72	1.971	221.54	3.30
Boron (100 ppm)	40.10	12.82	25.77	12.34	2.125	205.13	3.03
Cycocel (0.5 kg/ha)	31.22	11.66	25.62	12.95	2.168	179.22	2.90
Control	37.88	10.46	23.44	13.54	1.871	173.46	2.65
CD at 5%	1.44	1.13	0.232	3.512	0.261	5.12	0.13

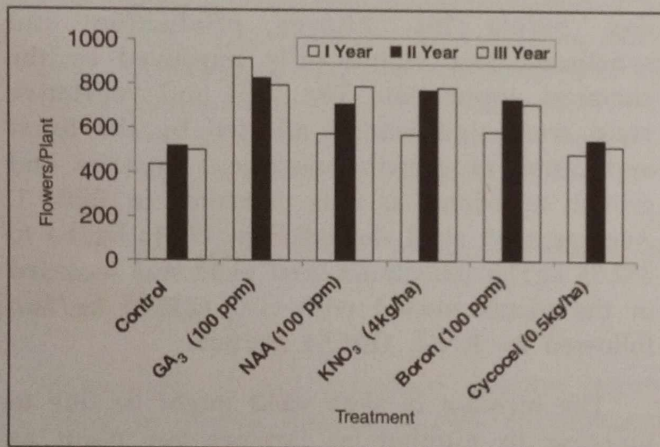


Fig. 1. Effects of foliar treatments of growth hormones, nutrients and growth retardant on flower production in *S. hamata*

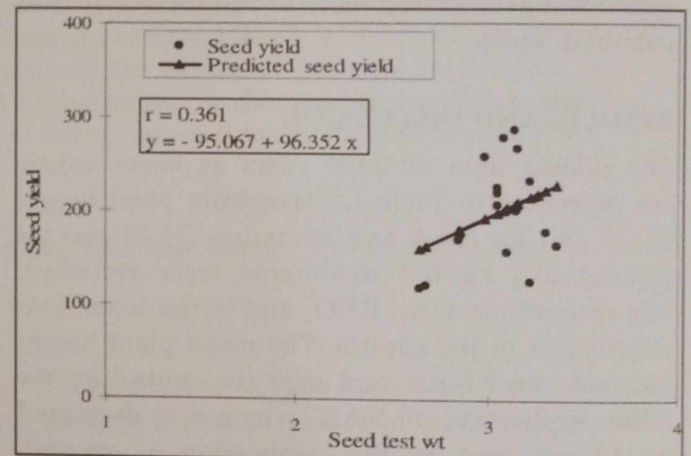


Fig. 3. Relationship between seed yield and seed test weight in *S. hamata* (under various treatments)

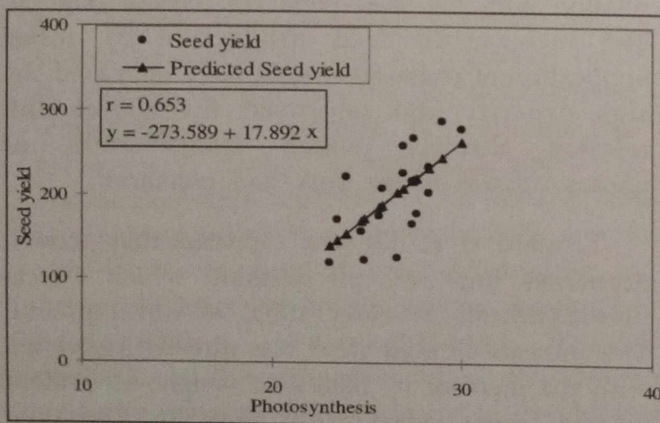


Fig. 2. Relationship between seed yield and photosynthesis in *S. hamata* (under various treatments)

maximal seed test weight was recorded by the foliar application of KNO₃ (3.30 g), followed by GA₃ (3.24 g) over the control (2.65 g).

Earlier workers reported that plant growth regulators modified the growth and development pattern by influencing various physiological processes and hence regulating the productivity [8, 9]. The superiority of foliar applied nutrition might be due to enhancing flowering and seed development in the plants. The nutrients absorbed by roots at peak period may not be sufficient to meet the needs of seed development. Thus, supplementing nutrients by foliar application

might have resulted in better nutrition management in plants leading to increase in seed yield. Similar observations were reported in groundnut [10] and pulses [11]. The present results showed that yield contributing characters and physiological attributes could be effectively altered by foliar application of growth regulators. Therefore, this investigation indicated that growth hormones and nutrients positively had influenced the morpho-physiological parameters and assimilatory functions in increasing the seed quality and yield of *Stylosanthes hamata*.

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