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Increased photosynthesis contributes towards improved ovule-to-seed ratio in IAA treated range grasses

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Introduction

Poor ovule-to-seed ratio is one of the major constraints in quality seed production in range grasses. Plant hormones per se or in the influence of external cues were known regulate the seed setting and their subsequent maturation in many crops. External application of hormones on the standing crops has shown very promising results but the physiological and biochemical phenomenon underlying such changes are not studied in detail. Exogenous application of different chemicals particularly during anthesis and post anthesis phases has increased the seed set in a number of species. Improved seed germination in *Panicum maximum* after foliar spray of indole acetic acid (IAA) has been reported by Malaviya *et al.*, (2013). but the reason for improved seed germination was not very much clear. Auxin application has also been shown to induce fruit-set in many crops. Auxins with its prominent role in cell division have been implicated to play vital role in integument growth during early seed formation (Wu *et al.*, 2006) and increased integuments has been correlated with increased seed size in *Arabidopsis* (Schruff *et al.*, 2006) where they postulate that increased integument provides larger seed cavity which in turn provides a greater area of contact for endosperm with the seed coat, leading to increased nutrient uptake. Increase in photosynthesis rate due to foliar application of many phytohormones has also been reported in many crops and understanding source sink relationship as influenced by different growth regulators might lead to significant breakthrough in understanding the seed production as a whole and seed filling in particular. Though the role of plant growth regulators in seed production is well researched in many crops but not much work has been undertaken to improve the production and quality of seeds in range grasses.

Panicum maximum and *Cenchrus ciliaris* are two most important range grasses of irrigated and non-irrigated conditions respectively and both produces seeds of very poor quality in terms of germination. Therefore, in present study we try to improve seed filling through foliar application of IAA in these crops and studied the photosynthesis behaviour post treatment.

Materials and Methods

The study was conducted at central research farm of Indian Grassland and Fodder Research Institute, Jhansi during 2012-2014. *P. maximum* var. BG-2 and *C. ciliaris* var. IGFRI-727 were planted in three replications in randomized block design to study the effect of IAA @100 ppm on seed setting and their photosynthesis behaviour. IAA was sprayed at anthesis initiation stage and photosynthesis data were recorded 24 hr after treatment. The matured seeds from treated and control plots were analysed for seed filling percent through X-ray radiography.

Results and Discussion

In *P. maximum*, X-ray radiography reveals that IAA @100 ppm has increased the seed filling percent from 18 to 48% while in *C. ciliaris* from 33 to 60% (Table 1). Earlier we have reported increased seed germination in *P. maximum* due to IAA treatment (Malaviya *et al.*, 2013) which might be due to improved seed filling as revealed by X-ray radiography. Rate of photosynthesis was found to be significantly increased in IAA treated plants of both crops (Fig 1a). Stomatal conductance was also significantly increased (Fig 1b) but chlorophyll content was not changed (Fig 1c) as expected. This indicates increased photosynthesis might be due to increased gaseous exchange. Increased photosynthesis with IAA treatment indicates possible role of photosynthates partitioning which need further investigation.

Table 1. Effect of IAA treatments on seed filling in *P. maximum* and *C. ciliaris*

Treatments	Seed filling (%)	
	<i>P. maximum</i>	<i>C. ciliaris</i>
Control	18	33
IAA 100 ppm	48	60

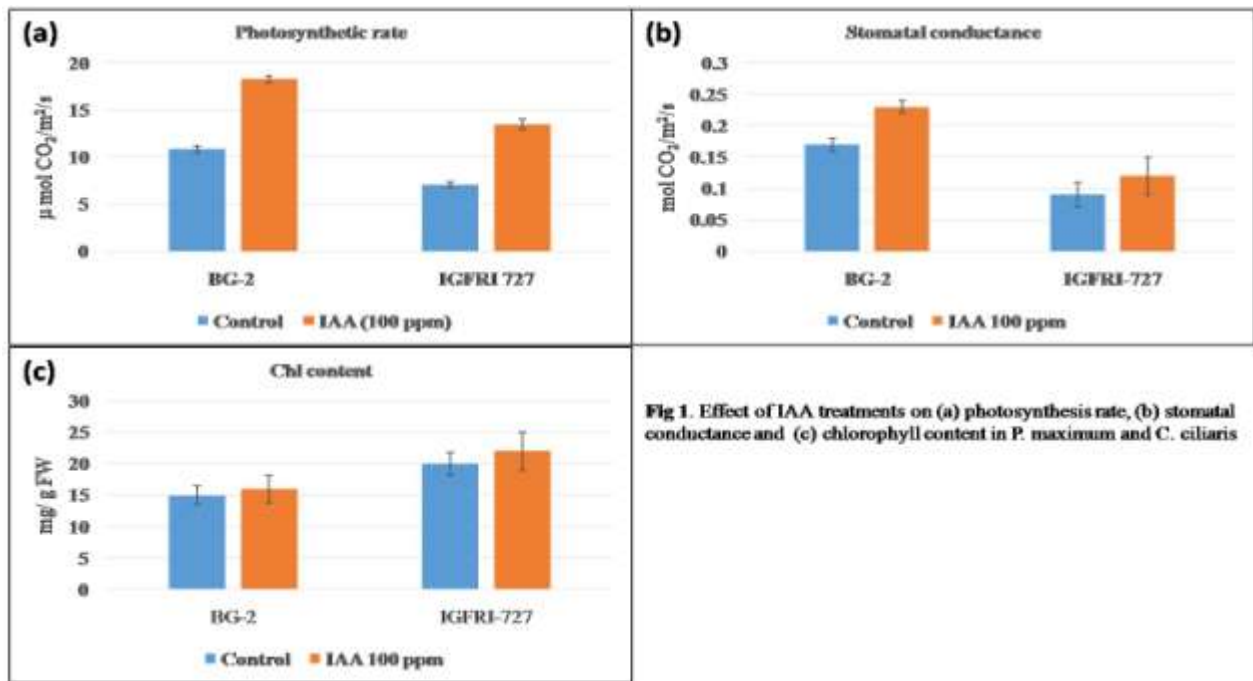


Fig 1. Effect of IAA treatments on (a) photosynthesis rate, (b) stomatal conductance and (c) chlorophyll content in *P. maximum* and *C. ciliaris*

Conclusion

The present study confirms that IAA 100 ppm spray at anthesis stage improves ovule-to-seed ratio in both *P. maximum* and *C. ciliaris*. The increased photosynthesis might have contributed more photosynthates towards developing seeds which led to increased seed filling, however, photosynthates partitioning pattern need to be ascertained to confirm the result beyond any doubt.

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