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Theme 2. Grassland production and utilization
Sub-theme 2.7. Seed production, storage, availability and quality

Anthesis dynamics, pollen availability and enhancement of seed to ovule ratio in *Chrysopogon fulvus*

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Introduction

Under the present scenario of severe green fodder shortage (64%) in India, grassland offers an opportunity to enhance fodder availability. To revitalize the existing denuded grasslands, seed is the best propagating material. Availability of quality seed in forage grasses is less than 20% of actual requirement/ demand. Hence, there is a need to enhance the production and productivity of grass seeds. Even the available grass seeds have very low germination percentage, which is mainly due to the absence of a caryopsis inside the fluffy seed material. *Chrysopogon fulvus*, commonly known as Guria grass or red false beard grass, is a tufted perennial tropical grassland species, with good palatability and green fodder potential of >20 t/ha. With its ability to grow under annual rainfall of 300-1200 mm it is well suited for the rainfed situation of Indian grasslands.

As per Indian minimum seed certification standards (IMSCS), the germination percentage of *C. fulvus* is only 15%. The low germination coincides with the low seed setting (14-18%) as recorded in bulk harvested sample by Bahukhandi *et al*. (2011). Enhancement of seed to ovule ratio not only increases germination percent but enhances productivity *per se*. With this background, the present study was undertaken to understand the reproductive morphology, pollen availability and effect of exogenous application of chemicals for enhancement of seed to ovule ratio in *C. fulvus*.

Materials and Methods

The study was conducted at the central research farm of the Indian Grassland and Fodder Research Institute, Jhansi during 2012-2014. *C. fulvus* var. Bundel Dhawlu Ghas-1 was planted in three replications in a randomized block design to check the effect of different hormones and chemicals on seed setting. The experiment included three hormones *viz*., Indole acetic acid, 100 ppm; Gibberellic acid (GA_3), 100 ppm; Kinetin, 100 ppm and two chemicals Tri Iodo Benzoic Acid (TIBA), 200 ppm and Cobaltous nitrate ($Co(NO_3)_2$), 100 ppm as well as control. The chemicals were sprayed twice during the booting and anthesis stages.

The reproductive morphology and pollen availability studies were conducted on ten randomly selected plants in the control plots for two consecutive years by counting the number of florets open each day in a panicle during the flowering period. The pollen viability was studied by counting 1% acetocarmine stained pollen at 100x resolution in ten random fields of observation in three replications each year.

Results and Discussion

Pollen availability, which is a prerequisite factor for seed setting, was determined by studying anthesis of both bisexual and staminate florets during the flowering period. In the panicle, spikelets are arranged in 7-8 whorls with the number of spikelets increasing from top to bottom, except in the last whorl, and anthesis takes place in a basipetal mannner. Each spikelet contains three florets, a central bisexual surrounded by two staminate florets. Even though *C. fulvus* is protogynous in nature, the opening of anthers takes place minutes after stigma emergence. The pollen from bisexual florets was available during stigma emergence and additionally, the secondary pollen source *i.e*. staminate florets started opening from the fourth day onwards and acted as a major pollen source from the fifth day of flowering (Fig. 1). Abundant pollen produced during anthesis of one panicle may act as a pollen source to other panicles. Thus, pollen availability, a critical resource for seed setting, was not limited in *C. fulvus*. Grasses are wind pollinated and produce abundant pollen as identified in high proportions in modern pollen assemblages (Vincens *et al*., 2006). After pollen availability, pollen viability is also equally important for successful seed setting (Kim *et al*., 2009). The viability of the available pollen in *C. fulvus* was tested with acetocarmine stain and it was found that 95% of pollen was fertile. Thus, after ruling out the pollen availability and pollen viability as reasons for low seed setting, the exogenous application of chemicals was used to enhance the seed to ovule ratio. Hormonal/ regulating chemical balance plays a crucial role in seed formation (Taiz and Zeigar, 2010). Application of hormones not only increased number of flowers but also caryopsis number inside the fluffy seed. Among different hormones/ chemicals tested, 100 ppm kinetin significantly enhanced the

number of seeds per head as well as seed setting percentage (Fig. 2). Similar observations with application of kinetin have been noticed in other crops (Passos *et al*., 2011).

Fig. 1: Anthesis duration and pollen sources in *C. fulvus*

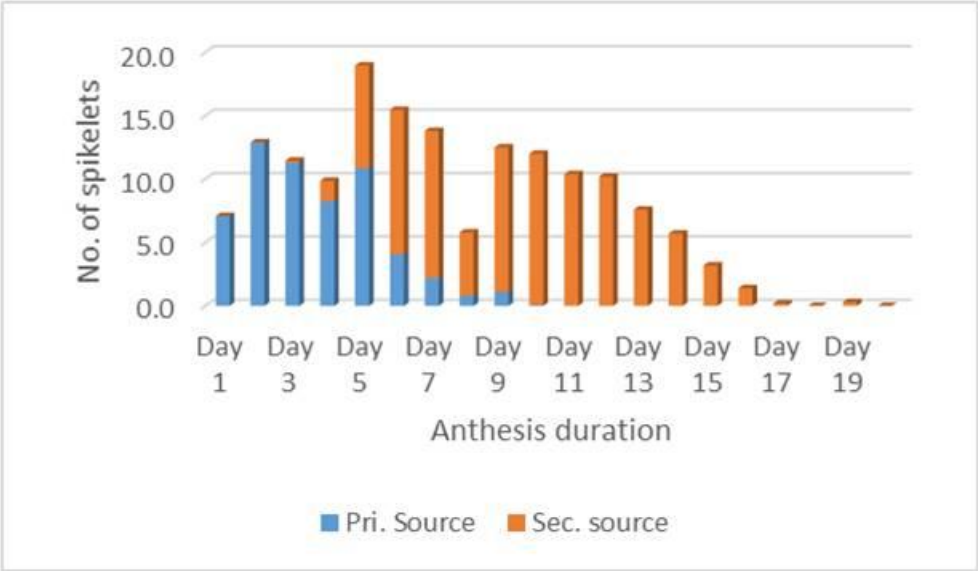
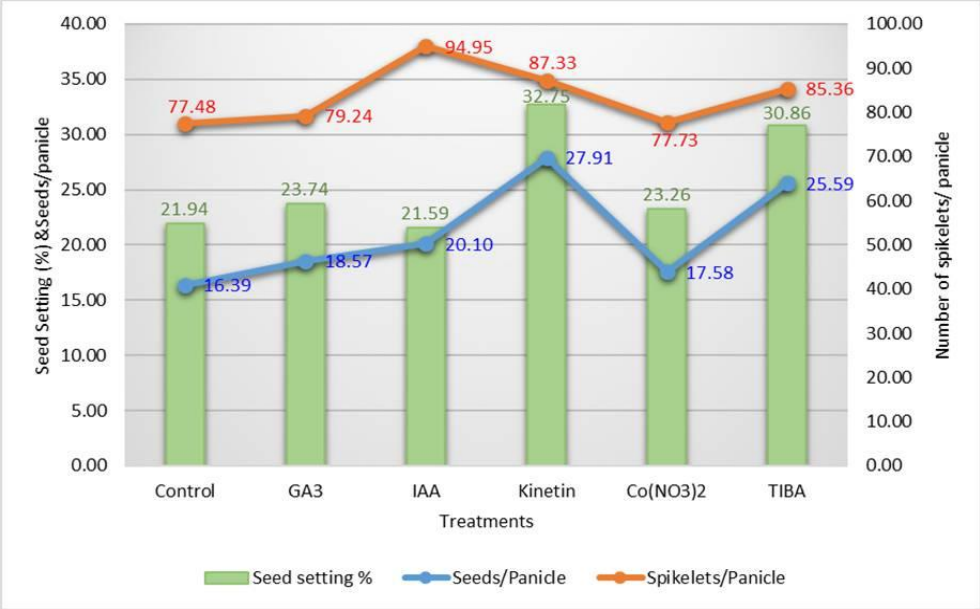


Fig. 2: Effect of treatments on seed filling in *C. fulvus*



Conclusion

The present study indicated that the pollen availability and viability are not the reasons for the observed low seed set in *C. fulvus*. The exogenous application of 100 ppm kinetin during the booting and anthesis stages helped in enhancing seed number as well as seed to ovule ratio. This finding may help in obtaining seed lots with increased germinability as more fluff contains caryopsis thus, the productivity per se could be augmented.

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