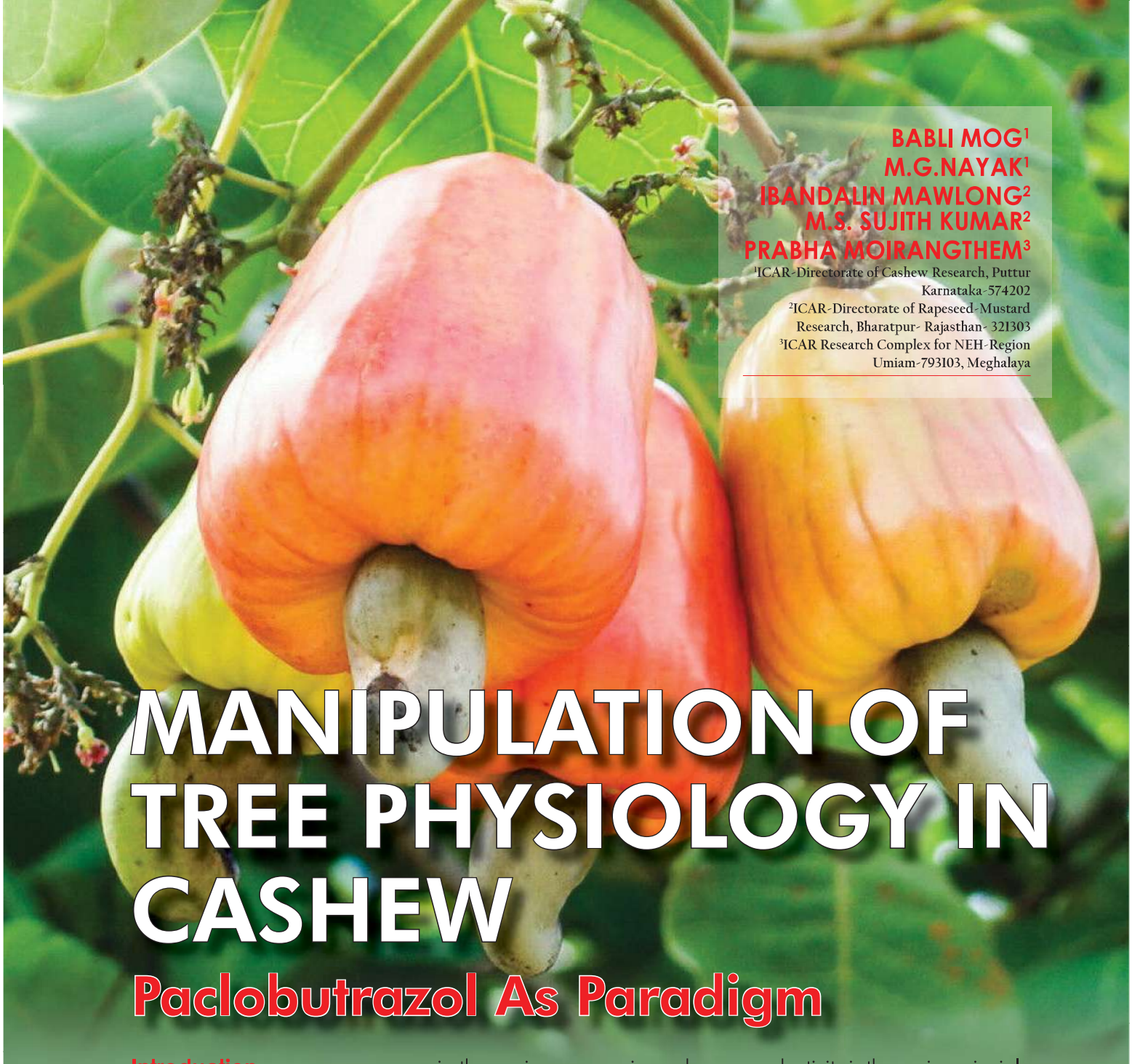

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MANIPULATION OF TREE PHYSIOLOGY IN CASHEW

Paclobutrazol As Paradigm

Introduction

Cashew has unique importance in human life as delicious snack food, for resource conservation and utilization of degraded lands, generation of employment opportunities and earning of foreign exchange. India is the first country which commercialized cashew as a horticulture crop. Research and development efforts on cashew have resulted in higher production yet, low productivity is the main concern in cashew cultivation in India. The major factors for low productivity are the large plantations under seedling origin and poor orchard management practices. At this juncture, when country is looking towards doubling farmer's income, high density is proved to be a successful venture in the initial few years to achieve higher productivity. Controlling excessive vegetative growth for increased or sustained productivity is the major principle of high density planting (Santra 1996). In cashew, due to non availability of dwarf clones, dwarfing root stocks or a pruning technology for the management of vigorous canopies, use of growth retarding chemicals viz., paclobutrazol assumes significance.

Properties of paclobutrazol

Paclobutrazol (PBZ), a non-polar broad spectrum growth regulator, has been characterized

as an environmentally stable compound in soil and water environments. Paclobutrazol is translocated acropetally via xylem in plants (Hamid and Williams 1997) although phloem translocation has also been reported (Witchard 1997). Paclobutrazol, a gibberellins inhibitor, has been effectively used in reducing canopy volume and increasing flower intensity in many fruit crops (Kulkarni 1988, Kurian and Iyer 1993). Thus, paclobutrazol holds considerable promise in manipulation of flowering, yield and vigour in fruit crops.

Figure 1: Mode of action of paclobutrazol in plants

Effects of paclobutrazol

Paclobutrazol has demonstrated its usefulness by regulating traits of agronomic interest in various crops including cereal, vegetables, fruits and ornamentals (Rademacher and Bucci 2002). It has been effectively used for flower regulation, yield and quality improvement in various perennial fruit crops (Nartvaranant et al. 2000).

Control of tree growth

Cashew is a fast growing woody perennial, covers the allotted space under high density planting, within a short span of 6-7 years. Hence, controlling excessive vegetative growth holds significance for increased or sustained productivity in cashew. The efficacy of paclobutrazol in regulating tree size and canopy has been reported in cashew (Meena et al, 2014). The reduced tree size and canopy growth may be attributed to decreased shoot growth and internodal length due to inhibitory effects of paclobutrazol on gibberellins biosynthesis pathways.

Regulation of flowering

Flowering in cashew is seasonal and produces innumerable flowers but only 1-2 per cent of the flowers set fruit and reach maturity. Production of more number of pistillate flowers and reduction in nut drop can be accomplished by the use of plant hormones. Paclobutrazol, a gibberellins inhibitor, can enhance the total phenolic content of terminal buds and alter the phloem to xylem ratio of the stem, which is important in restricting the vegetative growth and enhancing flushes , flowering by altering assimilate partitioning and patterns of nutrient supply for new growth (Kurian and Iyer 1992). The application of paclobutrazol has been effective in inducing early flowering in cashew (Meena et al, 2014). However, higher concentration leads to canopy compaction due to reduction in the length of new flushes.

Figure 2: Effect of paclobutrazol on panicle size

Regulation of fruiting

Fruit set and their retention are the major limiting factors for low yield in cashew

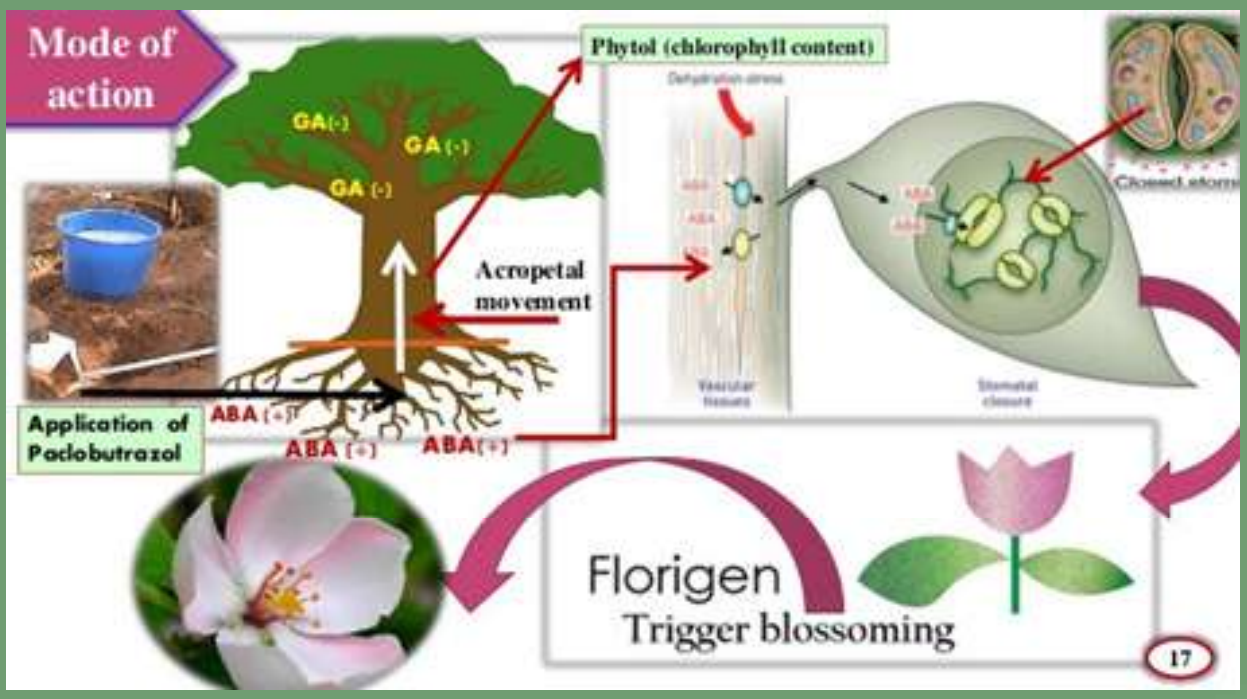

Figure 1: Mode of action of paclobutrazol in plants

Figure 2: Effect of paclobutrazol on panicle size

which needs due attention. The nuts that develop after pollination start drying followed by dropping, leading to very low percentage of matured nuts. The improvement of sex ratio, fruit set, fruit retention and yield by use of paclobutrazol have indicated beneficial effects in cashew. Increased fruit set and fruit retention due to application of paclobutrazol could be attributed to the increased number of bisexual flowers and reduced pre mature fruit drop in cashew. In addition, enhanced flowering synchronization and improved pollination have also contributed in increased fruit set in cashew.

Influence on nut yield

Among the various factors influencing cashew yield, the narrow sex ratio is of primary importance. Improvement in sex ratio with application of paclobutrazol was mainly due to increased number of bisexual flowers. PBZ has been reported to exert influence on partioning the photosynthates to the sites of flowering and fruit production consequent to the reduction of vegetative growth. Higher fruit set and fruit retention in the paclobutrazol treated plants had a favourable impact on culminating higher final fruit number and yield per plant (Meena et al, 2014).

Conclusion

Paclobutrazol holds significant potential for regularity and synchronization in flowering, yield enhancement and tree vigour. However, it is advisable to use the optimal dose at the right time to avoid indiscriminate soil application. The chance of environmental contamination may also be minimized if soil properties, varietal response and climatic conditions are taken into consideration before extensive commercial adoption of PBZ.

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