

PLANTING RATIO: THE BLUEPRINT FOR HIGH-QUALITY HYBRID SEED PRODUCTION

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Introduction

Planting ratio is the specific row or block arrangement of female (seed bearing) and male (pollen provider) parental lines in a hybrid seed production. Planting ratio is to ensure an adequate supply of pollen throughout the flowering period. The ratio varies depending on the crop flowering behavior, pollen abundance and available environmental conditions. Maintaining of the appropriate planting ratio can give direct economic benefits. It improves pollination efficiency, proper utilization of available field area, increases hybrid seed yield (Sharankumar and Merwade, 2013) and enhances profitability for seed growers. Since hybrid seed commands a premium price, even small improvements in pollination mechanism and seed set can significantly increase farmers income.

Importance of Planting Ratio

- Ensures adequate pollen availability: The primary objective of maintaining an appropriate planting ratio is to supply enough viable pollen during the flowering period. Every female flower must receive viable pollen for successful fertilization.
- Improves seed yield: Female rows produce the commercial hybrid seed. If pollen becomes limiting because of insufficient male rows, many flowers remain unfertilized. This directly reduces seed yield. Conversely, planting too many male rows also lowers production because male plants do not contribute to hybrid seed harvest (Venkatesh *et al*, 2017). Therefore, maintaining the optimum planting ratio maximizes productive female area while ensuring adequate pollination.

- Maintains hybrid seed purity: Hybrid seed purity is one of the most important quality standards in seed production. Proper planting ratio allows efficient cross-pollination between the designated parental lines while reducing the chances of contamination.
- Improves pollination efficiency: Pollination depends not only on pollen availability but also on pollen movement. Wind and insects transport pollen from male to female plants. If male rows are too far apart, pollen may not reach all female rows effectively. An optimum planting ratio shortens the distance between male and female plants and improves pollination efficiency.
- It promotes uniform and effective cross pollination.
- It restricts poor seed set.

Factors affecting planting ratio

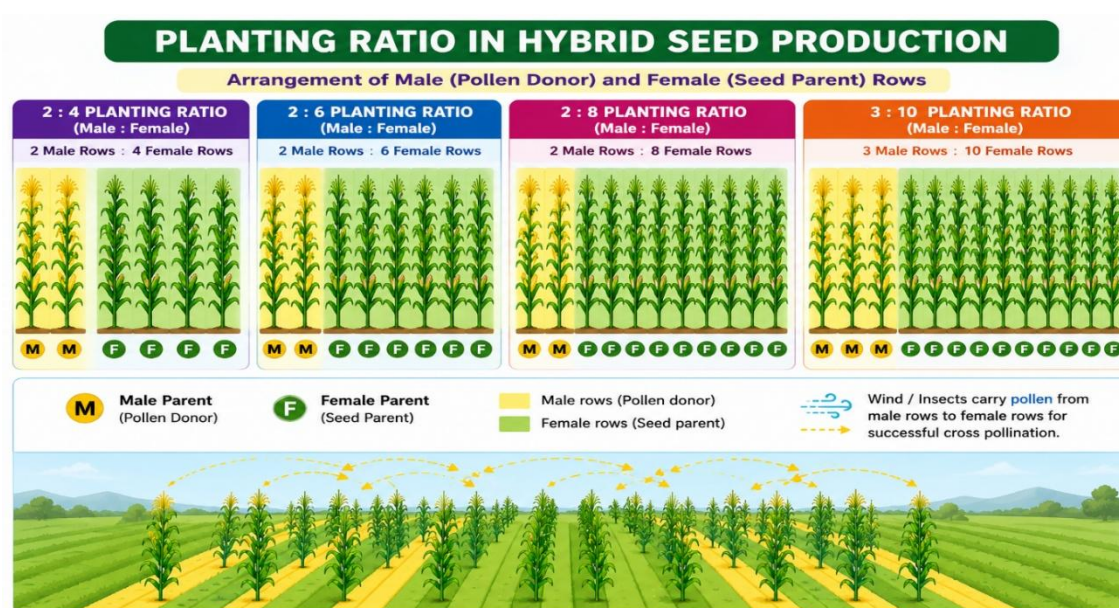
- Pollen viability and longevity of male parent: Some male parents produce abundant pollen, while others produce relatively less. High pollen-producing lines require fewer male rows than poor pollen producers. High pollen viability increases fertilization success. Low pollen viability may require additional male rows.
- Pollination mechanism: Wind-pollinated crops often require different row arrangements than insect-pollinated crops. In insect-pollinated crops, bee activity strongly influences pollination success.
- Synchronization of flowering: Male and female parents must flower simultaneously. If flowering periods do not overlap, even the correct planting ratio cannot ensure successful pollination.
- Crop species and its floral biology: Plant height, flowering habit, duration of pollen shedding, plant spacing (Sutradhar, H., *et al*, 2018) and stigma receptivity differ among crops and varieties, influencing the recommended planting ratio.
- Prevailing environmental conditions.

Consequences of Incorrect Planting Ratio

- Poor pollination
- Reduced seed setting
- Lower hybrid seed yield
- Uneven seed development
- Increased production costs
- Reduced profitability
- Failure to meet seed certification standards

Important planting ratio in agricultural system

Crop	No. of. Female rows	No. of. Male rows
Paddy	8 or 10	2
Maize	4 or 6	2
Sorghum	4 or 6	2
Bajra	4	2
Sunflower	3 or 4	1
Redgram	4 or 6	1
Cotton	4	1



Success experiments

1. Malagatti, M., *et al.* (2023), conducted a research on sponge gourd crop, results of the study showed that the planting ratios had no significant effect on vegetative growth and flowering behaviour of the parental lines, but had significant effect on fruit and seed yield of the parental lines. A planting ratio of 3:1(female: male) was found optimum for efficient hybrid seed production of Sponge gourd hybrid; Pusa Shreshta under North Indian conditions.
2. Manjulatha, G., *et al.* (2022), research study concluded that, female and male rows respectively 5 :1 planting ratio can be recommended to achieve higher hybrid yields and profits compared to recommended 4:1 planting ratio for single cross hybrid.

Conclusion

In hybrid seed production every row matters. A well planned planting ratio is not just a field arrangement, it is the key to efficient pollination with higher seed set. As hybrid technology continues to progress the agricultural productivity by adopting the optimum planting ratio remains a simple yet powerful practice for production of high quality hybrid seed and to meet the growing demand for food security. Planting ratio is one of the simplest yet most influential practices in hybrid seed production. It determines the balance between pollen availability and the productive area occupied by female plants. By understanding and adopting the recommended planting ratio for each crop, seed producers can achieve efficient hybrid seed production while contributing to the availability of quality seed for sustainable agricultural development.

References

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