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Marigold for Aesthetic beauty and prosperity .....

A. Suklabaidya, Biswajit Das **and** M. Datta
ICAR (RC) for NEH Region, Tripura Centre, LEMBUCHERRA (TRIPURA) INDIA

Marigold is one of the important commercial flower crops of India, which ranks first among the loose flowers. It is not only grown as a cut flower and in landscaping but also as a source of natural carotenoid pigment, 'xanthophyll. It is used in poultry industries to intensify yellow-orange colour of egg yolk and broiler skin. Marigold is highly suitable for cultivation under different argoclimatic condition and its flowers and petals are of economic importance. It also acts as a trap crop to control fruit borer in tomato and suppresses the nematode population. Its scientific cultivation fetches handsome return of Rs. 30,000- 60,000/acre, improving the livelihood of small and marginal farmers throughout the year.

Marigold (*Tagetes erecta* L.), which occupies a prominent place in ornamental horticulture, is one of the commercially exploited flower crops belonging to the family Asteraceae. Marigold is broadly divided into two groups, *viz*., African marigold (*Tagetes erecta* Linn.) and French marigold (*Tagetes patula* Linn). The former generally grows tall and is known as tall marigold and latter is short called as dwarf marigold.

The name *Tagetes* was given after 'Tages', a demigod known for his beauty. Marigold has been named after Virgin Mary. The king Curtez after conquering Mexico got fascinated by the beauty of the flower and carried it to Spain. It was then offered to the attar of Virgin "Mary" and thus named as Mary's gold, now, popularly known as marigold.

Its habit of free flowering, short duration to produce marketable flowers, wide spectrum of attractive colours, shape, size and good keeping quality has attracted the attention of flower growers. It is put to many uses like cut flowers, garden displays, garlands, bouquets and for worship. Flowers are commonly extensively used for decoration in various religious and social functions. Apart from its significance in Ornamental Horticulture, it has been valued for other purposes too. The aromatic oil extracted from *Tagetes minuta* which is being traded as "Tagetes oil" is a fly repellent and has also got larvicidal properties. It is also being grown as trap crop in agriculture against some of lepidopterans, coleopterans and nematodes. Besides, marigold is growing today as an commercially important source of carotenoid pigments. The principal pigment present in the flowers is xanthophyll, particularly lutein accounts for » 80 -90 per cent and is present in the form of esters of palmitic and myristic acids. Marigold carotenoids are the major source of pigment for poultry industry as a feed additive to intensify the yellow colour of egg yolks and broiler skin. The ground blossom meal (petal meal) or the extract, usually saponified for better absorption, is added to the poultry feed. These products are traded as 'Aztec marigold' or marigold extract as 'Adoptinal'.

Soil and climate : Marigold can be grown successfully in a wide variety of soils. The soil should be well drained, well aerated, deep, fertile, good water holding capacity and neutral soil reaction (pH 6.5 -7.5). Saline and acidic soils are not suitable for cultivation. An ideal soil for marigold cultivation is fertile sandy loam. African and French marigold both are hardy in nature. They can grow well throughout the year under tropical and subtropical conditions but requires mild climate for luxuriant growth and flowering.

Varieties : The growth and flowering in marigold are generally controlled by light duration and temperature, therefore, selection of varieties should be according to climatic conditions. The suitable varieties for growing in different seasons is given in Table 1.

Sowing time and season: Depending on environment planting of marigold can be done in three seasons *i.e.* rainy, winter and summer and seeds are sown accordingly. Hence, flowers of marigold can be obtained throughout the year. The seasons of sowing and transplanting of seedling for obtaining flowers at different seasons of a year are is given in Table 2.

Propagation: There are two common methods of propagation of marigold *i.e.* by seeds and by cuttings. Plants raised from seeds are tall, vigorous and heavy yielder and hence, seed propagation is preferred to cuttings. The marigold seeds are black in colour and remain viable for about 1-2 years for rising of seedlings, seeds should be

sowed in pots, seed boxes or raised nursery beds. Nursery beds are prepared by digging area and incorporating well rotten FYM. Before sowing the seeds, the soils should be drenched with Captan to avoid the ants, which carry away the seeds. Seeds should be sown thinly (6-8 cm row to row) and 2cm deep and covered with sieved leaf mold. The nursery beds should be remained moist during entire period. The quantity of seed required depends upon the level of its purity and germination rate. Generally 200-300g seed/acre is required for raising the nursery in summer and rainy season, and 150-200g/acre for winter season. The seed germinate 4-5 days after sowing and seedlings become ready for transplanting after 3-4 weeks for sowing.

Indoor containers : The best type of indoor pots for a marigold plant should be medium-sized, about 5 to 6 inches in diameter if they are grown from seedlings or seeds. The best type of pots are clay or ceramic with holes in the bottom for drainage. Add a layer of pebbles at the bottom of the pot before adding the soil. Place the soil in a shallow bowl to help catch the water that drains out whenever the plant is watered.

Outdoor containers : Use 16 to 18-inch pots for the young marigold plants. Self-watering clay, ceramic or cement pots will keep the soil moist outdoors even in dry weather. If a self-watering pot is not available, you can use a regular one and just check the soil each day for moisture levels.

Potting soil : Marigolds prefer moist soil. Add some clay mixture to regular potting soil to help make it retain moisture. We can also add a slow-acting granular fertilizer to help encourage as many blossoms as possible. Do not use potting soil directly as this will be too dry.

Transplanting of seedlings : Marigold seedlings are easily transplanted and established in the field without much mortality. At the time of transplanting, they should be stocky and bear 3-5 true leaves. Thin and long seedlings do not make a good plant. Very old seedlings are also not desirable. Transplanting should be done in well prepared land and soil is pressed around root zone to avoid air pocket. After transplanting, a light irrigation or watering with rose cane should be done.

Spacing : Plant density depends largely upon the growth habit, cultivar and the soil type. In general, spacing should be 30 cm x 30 cm for French marigold and 40 cm x 40 cm for African marigold. Proper spacing between plants is required for better development of plant and higher flower yield.

Manures and fertilizers : Since marigold is fast growing crop, it requires high dose of nitrogen and moderate level of phosphorous and potash for better root development and quality flowers. Therefore, 40-50t/ha FYM should be applied at the time of land preparation. In addition to FYM it is advisable to apply 200 kg/ha nitrogen and 80 kg/ha each of phosphorous and potash for good flower yield. The full dose of phosphorous and potash should be given before transplanting while nitrogen is given in two split doses (30 and 60 days after transplanting).Foliar spraying of urea @ 1 per cent is also applied for getting quality flowers.

Weeding, hoeing and irrigation : Weeds are a major problem in marigold especially in rainy season crop. If the weeds are not removed in time, a great loss would occur in terms of growth and productivity of marigold. Normally 3-4 manual weeding and hoeing are required to check weed growth and to keep the field clean. Irrigate the crop in 7-8 days interval, but the frequency and quantity of water also depend upon soil and season. In lighter soil, more frequent irrigation is required than that in heavy soil. Moisture stress at any stage of crop growth can adversely affect the growth and development, therefore it is essential that soil should remain moist and heavy irrigation should be avoided.

Pinching : Pinching (removal of terminal portion) is done

Table 1 : Suitable varieties for growing in different seasons

Seasons	Varieties
Winter	Pusa Narangi Gainda, Pusa Basanti Gainda, African Gaint Double Yellow, African Giant Double Orange, Tiger (yellow and red) and Inca Hybrid (orange and yellow)
Summer	Cracker-Jack and Locals
Rainy	African Giant Tall Yellow, African Giant Tall Orange, Calcuttia, Jaffri (yellow and orange), Laddu Gainda.

Table 2 : Seasons of seed sowing and transplanting of seedlings

Flowering season	Sowing time	Transplanting time
Late rains	Mid-June	Mid-July
Winter	Mid-September	Mid -October
Summer	January-February	February-March

Table 3 : Important diseases and pest, their symptoms and management of marigold

Diseases/ Pests	Symptoms and damage	Managements
Damping off *Rhizoctonia solani*	Brown necrotic spots and girdling on the radicle, later on extends to plumule and causes pre-emergence mortality.	Infected seedlings are pulled, sterilization of soil with Formalin@ 2% or Captan 2g/ litre of water.
Leaf spot and blight *Alternaria* sp., *Septoria* sp., *Cercospora* sp.	The minute brown circular and brownish-grey spots appear on the leaves.	Spraying Blitox 50 regularly.
Collar and root rot *Pellicularia filamentosa, Pythium ultimum, Sclerotinia slerotiarum*	Rotting of root and collar portions is noticed in nursery stage which resulting in wilting of the plant.	Soil sterilization and controlled watering.
Flower bud rot *Alternaria dianthi*	Buds are shriveled, turn dark brown and dry up. Symptoms are less prominent on matured buds but these buds also fail to open.	Spraying Dithane M- 45 and Ridomil @ 2.5g/lit of water and use of quality seeds.
Bud caterpillars *Helicoverpa armigera and Phycita sp.*	Eggs are laid singly on young buds. Larvae feed on developing flowers by damaging florets. Larvae of Phycita sp. feed on heads of buds and flowers.	Collection and destruction of infested buds and flowers.
Aphids *Aphis gossypii*	Aphids mainly infest lower surface of flowers and base of petals. Nymphs and adults suck the sap from the flowers causing discolouration and withering.	2-3 sprays of Imidachloropid solution 0.25%.
Red spider mite	Appears in the flowering time. Plants give dusty appearance. Common in late winter and early-winter crop.	Spraying of Kalthane or Dicofol.

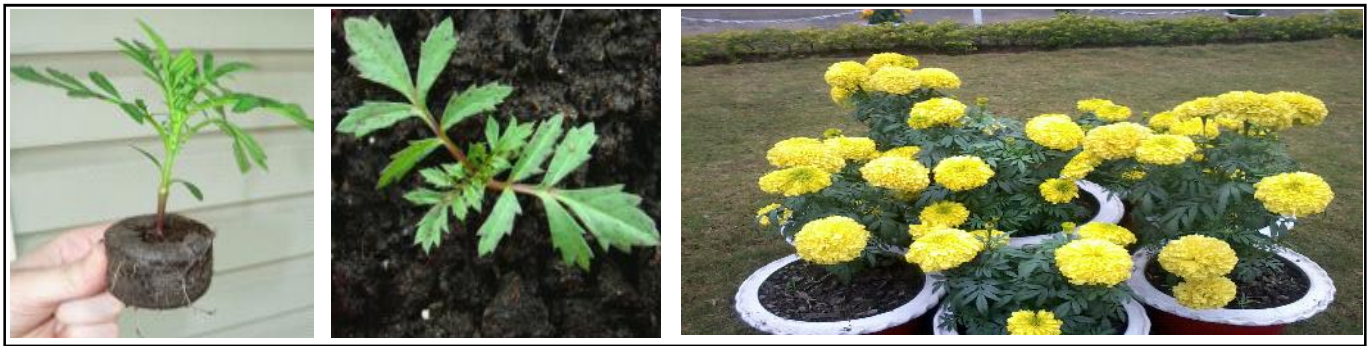

Fig. 1 : Marigold seedlings ready for transplanting (left), transplanted seedling (middle) and flowering (last)

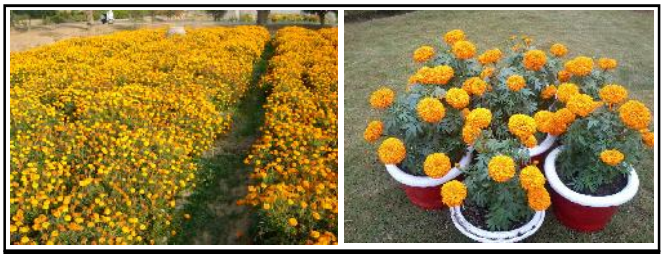

Fig. 2 : Marigold plants in full blooming stage

as breaking of apical dominance mechanically to promote laterals and increasing the number of flowers. In African marigold pinching is recommended after 30-35 days of transplanting when plants attain a height of 30-40 cm or before bud formation. Second pinching is also done occasionally to avoid the glut or to catch markets.

Diseases and pests : Marigold is relatively free from diseases and insect pests. However, occasionally the following diseases and insect-pests have been observed (Table 3).

Harvesting and yield : Plucking of flowers at proper stage is important during harvesting to keep the flowers fresh for a longer time for export purposes. Marigold flowers are plucked when they have attained the full size. Plucking of flowers should be done in cool hours of the day either in the morning or evening. Flower yield in both types varies with cultivars, cultural practices like planting time, spacing and fertilizers. The flower yield in African marigold ranges from 125-150q/ha whereas, it is 80-120 q/ha in French marigold.

Summary : Maximum flower yield (10.70 tonnes/ha) was recorded in june-planted crop, followed by September-planted (8.48 tonnes/ha) one, whereas the minimum (2.61 tonnes/ha) in January-planted crop. Highest net return (Rs 112115/ha) was obtained from June-planted crop, with benefit: cost ratio of 3.29, followed by that of September-planted crop, with benefit: cost ratio 2.60. The value - addition like extraction of xanthophill (7-8kg/ha) may fetch more returns.

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