A Report on Performance of Marigold (Tagetes erecta) cv. African Orange in Different Location of Nepal.





Floriculture Association Nepal

Jwagal, Lalitpur

March, 2018

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Study Team

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Acronyms

/	Per
cm	Centimeter
CV.	Cultivars
DAP	Di-ammonium Phosphate
DAT	Days After Transplanting
FAN	Floriculture Association Nepal
Fig.	Figure
FYM	Farm Yard Manure
et al.,	(et alii) and others
gm	Gram
i.e.	That is
kg	Kilogram
MOP	Muriate of Potash
NPK	Nitrogen, Phosphorus, Kalium

TABLE OF CONTENT

S.N.	Title	Page No.
1.	Introduction	
	1.1 Background Information	1
	1.2 Rationale of the Study	2
	1.3 Objective of the Study	2
2	Materials and Methods	
	2.1 Seedlings Preparation	3
	2.2 Location	3
	2.3 Crop cultivation and management measures	4
	2.4 Parameters Recorded (Data taken)	5
3	Result and Discussion	
	3.1 Numbers of Branches	5
	3.2 Plant Height	6
	3.3 Days to flowering	6
	3.3.1 Numbers of flower production	7
	3.3.2 Weight of flower	7
	3.4 Weight of plant	9
	3.5 Flower production	9
4	Summary	10
5	Conclusion	11
6	Recommendations	11
	References	12
	Annexes:	
	Annex 1: Responsible Growers in Different Districts	13
	Annex 2. Data Collection Sheet	14
	Annex 3: Performance of Marigold in Different Locations of Nepal	15
	Annex 4: Photographs	16

A Report on

Performance of Marigold (Tagetes erecta) cv. African Orange in Different Locations of Nepal.

Abstract

Marigold is one of the popular flowers in Nepal. It has aesthetic as well as cultural value. A study was conducted during 2017 to determine suitable locations and explore the feasibility of cultivating marigold (Tagetes erecta) cv. African Orange for flower production to utilize the pigment in poultry industry. The marigold seedlings planted on July 2017 in different 10 districts. Highest no. of branches was recorded at Kaski followed by Chitwan and Dang; Maximum plant height was observed at Chitwan followed by Kavre and Kaski. The Marigold plants grown at Kaski bloom earlier followed by Gulmi, Chitwan and Sunsari. Similarly, Maximum no. of flower production was recorded at Dang followed by Chitwan and Kaski. Highest weight of plant was reported from Gulmi followed by Chitwan, Kaski and Baglung. Highest flower production per plant recorded from Gulmi followed by Chitwan and Dang. Thus, Gulmi, Chitwan, Dang and Kaski were found better districts for marigold cultivation for flower production.

Key Words:

African Orange, Locations, Marigold (Tagetes erecta), Production

1 Introduction

1.1 Background Information

Marigold is one of the most important flowers in Nepal. It has religious and cultural values, especially during Tihar festival. Marigold flowers have a rich golden history in Nepal and extensively used on religious and social functions in one forms or other. Garlands of marigold are widely used in Nepalese fest and festivals especially in Tihar. Marigold cultivation is attracting attention of flower growers on account of its easy culture, wide adaptability and short duration to produced marketable flowers and gaining popularity amongst flower dealers due to its wide spectrum of attractive color, shape, size and good keeping quality (Arora, 1998). Marigold flowers have an important position during Tihar festival (festival of flowers and lights). It is estimated that the Kathmandu Valley alone consumes around 75 percent of the marigolds sold across the country during Tihar (Floral Daily, 2017). Most of the marigolds sold in Nepal are grown in Kathmandu valley, Kavre, Nuwakot, Dhading, Kaski and Chitwan. Around 30 percent of the requirement is imported from India. Marigold flowers used to prepare garland, arranged with the leaves of fern and other ornamental leaves such as mango to welcome the people in different occasions as well as to offer the flowers to the god in different offerings (Gaenszle et al., 2005). Garlands are widely used in Nepalese fest and festivals. Many farmers grow marigold in commercial level, some farmers have been benefitted economically from its cultivation during normal and

off seasons (Adhikari and Pun, 2011).

African marigold (*Tagetes erecta* L.) flower pigments can be extracted and used in poultry feed as a natural food additive to color egg yolks orange and poultry skin yellow (Bosma et al., 2003). Lutein $(C_{40}H_{56}O_2)$ is the major pigment present in the marigold flower. African marigold (*Tagetes erecta*) petals are commercially important as a natural source of pigments - lutein (yellow-orange) and are mainly being used by the poultry sector as feed additives to color egg yolks orange and poultry skin yellow (Gupta, 2014). Although marigold flower extract has been used in veterinary feeds, the potential use of marigold as a natural food colorant has not been exploited to the full extent due to the lack of information on its safety, stability, and compatibility in foods (Sowbhagua et al., 2006).

Petals of marigold flower are rich in Xanthophyll (Lutein) which is used as feed additive in poultry and fish industry. Marigold pigment increase the skin color and egg yolk, fish skin, and also used in drugs and drinks (MKCT Jacky, 2015). According to Jacky, processing of marigold petals includes flower production, silage production, press water out, dehydration and pelleting. To produce 1 kg pellet 10-13 kg fresh flower is necessary. Similarly, the pellet to oleoresin is around 8-9:1. The concentration of xanthophyll is 140-180 gm/Kg. Saponification process is required to produce final product - oleoresin. Final product oleoresin liquid 11 gm is produced from 1 kg fresh flower. Mexico is biggest market of Xanthophylls followed by South America, Spain, Italy, and China. Gaire in 2014 mentioned, there is interest of a company from Hong Kong for the collection of marigold pigment and possibility of establishment of a drying factory in Nepal. The trial study for marigold cultivation for the production of marigold flower for pigment processing should perform in different parts of country to find suitable locations.

1.2 Rationale of the Study

Nepal has various agro-climatic situations that favor commercial production of many crops including marigold. The suitable condition for marigold cultivation is where summer is not very hot and winter not too severe. Variety and growing conditions with vivid climatic situations (temperature, relative humidity and sunlight) differ in growth and production of marigold flower (Khanal, 2014; Dhakal and Bhattarai, 2017). Marigolds are the flowers which could be grown in a wide variety of soils, which requires mild climate for luxuriant growth and profuse flowering (FAN, 2016). Though, no work has been taken up to standardize its suitable location for cultivation of marigold (*Tagetes erecta*) cv. "African Orange" in Nepal. Besides, the use of Marigold flower for the production of pigments has not been explored in Nepal. Normally, marigold is used as garlands in cultural and social purpose. Thus, this study is novel to utilize marigold flower for poultry feed. This will also help to substitute the importation of such pigments required for poultry feed in the country.

1.3 Objectives of the Study

This study was conducted to assess the suitability of location for commercial cultivation of Marigold (*Tagetes erecta*) cv. "African Orange" in Nepal to produce pigments that could use in poultry feed.

2 Materials and Methods

2.1 Seedlings Preparation:

Seeds of marigold (Tagetus erecta) cv. "African Orange" that brought from China were used to produce seedlings at Kathmandu districts (Fig. 1 and Annex 1). Seedlings were provided to flower growers in ten different districts all round the country. Seedlings were transplanted on 3rd to 4th weeks of July, 2017 in open field condition. Data collection sheet was provided to the growers (Annex 2) and collected till December, 2017.

Crop: Marigold, Variety: African Orange Date of planting: July 2017 (2074. Sawan 1-15) Date of data collection: till Dec., 2087 (2074. Poush

2.2 Location:

The districts selected for production trial of marigold flower by Floriculture Association Nepal were selected for field trial (Table 1 and Figure 1).

S.N.	District	Address
1	Kaski	Chaura
2	Gulmi	Tamghas
3	Baglung	Tarakhola
4	Kavre	Panauti
5	Myagdi	Bharjula
6	Chitwan	Meghauli
7	Dang	Ghorahi
8	llam	Ilam
9	Lamjung	Besisahar
10	Sunsari	Itahari

Table 1: Districts and address of field trial locations



Fig. 1: Map showing study locations

2.3 Crop cultivation and management measures:

The field was plowed into fine soil tilth with depth around 40-50 cm. Leveling of the field was make properly after incorporation of FYM in soil and then layout was done. Small pits were prepared maintaining 50×50 cm spacing and the plot sizes were 200-500 m2. Recommended dose of fertilizers were applied.

Manure and fertilizer recommendation at the rate of 20-25 ton, 200:100:100 Kg N:P:K. in the form of oilseed cake, Urea, DAP, MOP were mixed with soil. Full dose of compost, P and K and 1/3rd dose of N were applied as basal while the other rest amount of N were applied as top dressing 1st and 2nd month after planting.

Seedlings having 2-4 sets of true leaves (one month old) were transplanted during evening hour. Irrigation was provided immediately after planting, fertilization and as and when necessary depending up on soil and weather condition. Pinching was done 30 DAT. After pinching top dressing of fertilizer was done in soil followed by hoeing, weeding, earthing-up and irrigation. Top dressing of remaining nitrogenous fertilizer was done 60 DAT during flowering stage. Plant protection measures such as spraying of pesticides were applied regularly. Damping off was major disease observed just after transplanting which was recovered after dreanching Carbendazin 1.5 gm per liter water. Whereas, leaf blight was main disease in field condition. Fungicides such as Mancozeb, Mancozeb+Metalaxyl, Copperoxychloride and Hexaconazol were sprayed to manage leaf blight problem. Representatives from FAN visited the trial sites at least twice and observed the field condition, provided feedbacks for crop management and data collection. Collected data were analyzed using Microsoft excel 2007 the results were presented in the graphs and tables to prepare the report.

2.4 Parameters Recorded (Data taken):

Data were recorded on various vegetative and flowering parameters.

- 1. Average no. of branches
- 2. Plant height (cm)
- 3. Days to flowering from plantation
- 4. Average no. of flowers per plants
- 5. Average weight of flower (gm)
- 6. Total flower production per plant (kg)
- 7. Average weight of plants (kg)

3. Result and Discussion

3.1. Numbers of Branches:

Average numbers of branches were 17.18. Maximum numbers of branches were recorded in Kaski (18) followed by Chitwan (17.80) and Dang (17.80) (fig. 2). Numbers of branches in marigold plant depend on the varietal characteristics, crop nutrient management and pinching practices. Numbers of branches contribute to the flower production in marigold.



Fig 2. Numbers of branches of marigold (Tagetus erecta) cv. African Orange in different locations of Nepal on 2017.

3.2. Plant Height:

Highest plant height (63 cm) was measured in Chitwan and Kavre followed by Kaski (62 cm). Whereas, average plant height in different locations was 58.7 cm (fig. 3). The plant height depends on the varietal characteristics, growing conditions and management measures.



Fig 3. Plant height of marigold (Tagetus erecta) cv. African Orange in different locations of Nepal on 2017.

3.3. Days to flowering

Precocity of flowering was found in Kaski, Gulmi, Chitwan and Sunsari i.e. 53 days. Whereas, average days to flowering from transplanting was recorded 54 days. The days of flowering was found similar i.e. 53 to 56 days after transplanting in all locations (fig. 4).



Fig 4. Days to flowering of marigold (Tagetus erecta) cv. African Orange in different locations of Nepal on 2017.

3.3.1. Numbers of flower production:

Maximum numbers of flower production was recorded in Dang (129.07) followed by Chitwan (128.80) and Kaski (127.47) (fig. 5). Whereas, the average numbers of flowers production per plant was recorded 124.88. The location that produce highest number of flower production could be good site for the flower production.

3.3.2. Weight of flower:

Highest weight of flower recorded from Gulmi (27.70 gm) followed by Ilam (27.20 gm) and Chitwan (26.80 gm) (fig. 6). Whereas, average weight of individual flower as a whole was 26.47 gm. Weight of flower is important parameters.

The interaction effect of numbers of flower production and weight of flower reflected that there is inverse relationship. Chitwan was observed as the best location in terms of both attributes.



Fig 5. Number of flower production of marigold (Tagetus erecta) cv. African Orange in different locations of Nepal on 2017.



Fig 6. Weight of flower of marigold (Tagetus erecta) cv. African Orange in different locations of Nepal on 2017.

3.4. Weight of plant:

Weight of plants was recorded highest in Gulmi (2.29 Kg) followed by Chitwan (2.26 kg) and Kaski (2.24 kg) (fig. 7). The average weight of individual plant was recorded 2.17 kg.



Fig 7. Weight of plant of marigold (Tagetus erecta) cv. African Orange in different locations of Nepal on 2017.

3.5. Flower production

Total quantity of flower production is an important attribute. Gulmi (3.50 kg) followed by Chitwan (3.45 kg) and Kaski (3.39 kg) were found higher flower production. Whereas, the average flower production was recorded 3.29 kg.

Total flower production per unit (area/plant or what need to specify)



Fig 8. Flower production per plant of marigold (Tagetus erecta) cv. African Orange in different locations of Nepal on 2017.

The vegetative and yield attributing parameters of marigold flower assessed through the trial study in different ten locations of Nepal. All parameters have few differences in all of the locations of the study. These minimum differences in the different ten locations might be due to the same season of growing before peak winter. The quality of marigold flower to produce pigment pellets and extraction of oleoresin/pigment respectively is higher from the products grown in sub-tropical to mild temperate region than the tropical regions (Personnel Communication, 2015). So, the hilly districts showing better performance in the trial study should be focused for the cultivation of marigold for flower production for processing and production of oleoresin. The pigment from marigold flower is widely used in poultry feeds for quality eggs and meat production. Thus, the resource poor farm family could be engaged for marigold flower production that sell for processing. It will generate employment opportunity and extra income for their livelihood and prosperity.

4. Summary:

S N	Parameter	Top 3 Locations (districts)	Average value	
1	Highest no. of branches	Kaski, Chitwan, Dang	17.18	
2	Maximum Plant height	Chitwan, kavre, Kaski	58.7	
3	Earlier flowering	Kaski, Gulmi, Chitwan, Sunsari	54 days	
4	Maximum no. of flower production	Dang, Chitwan, Kaski	124.88	
5	Highest wt. of flower (gm)	Gulmi, Ilam, Chitwan	26.47 gm	
6.	Maximum weight of plants (kg)	Gulmi, Chitwan, Kaski, Baglung	2.17 kg	
7.	Maximum flower production per plant (kg)	Gulmi, Chitwan, Dang	3.29 kg	

5. Conclusion:

Among the different growth and yield attributing parameters assessed by this trial study, maximum weight of plant and maximum flower production per plant were found highest in Gulmi and followed by Chitwan, Kaski, Baglung and Dang. However, the quality flowers production for oleoresine/pigment extraction is attain higher in cooler area than the hot. So, the production of marigold flower for processing should focused in the hilly area. The location of the further commercial production could be selected assessing the accessibility and other factors. Production of pigment from marigold should also assessed. This is a novel enterprise and exported oriented industry in the agricultural sectors. It will help to generate employment and income by utilizing marginal lands in the country.

6. Recommendations:

Commercial production of marigold flower could be focused in the Gulmi, Chitwan and Dang districts. In Nepal, the use of marigold flower is only for ornamentation purpose. Moreover, the pigment extract from marigold flowers is used as an additive in poultry feed, to impart bright color to egg yolk, skin, and fatty tissues as the poultry pigmentation is often associated with good health. The composition of pigments (lutein compound) in the petals of marigold flower is important for the application of marigold extract in nutritional supplements and increases its value as poultry feed colorant. So, study for the selection of suitable varieties and location/s for pigment production should be conducted. Further, the analysis of pigment compound content and their amount should be performed.

A REPORT ON PERFORMANCE OF MARIGOLD (TAGETES ERECTA) CV. AFRICAN ORANGE IN DIFFERENT LOCATIONS OF NEPAL.

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S.N.	District	Address	Responsible Grower			
1	Kaski	Chaura	Krishna Khatri			
2	Gulmi	Tamghas	Prem Bahadur Magar			
3	Baglung	Tarakhola	Prakash Gharti Magar			
4	Kavre	Panauti	Birendra Shrestha			
5	Myagdi	Bharjula	Bir bahadur Pun			
6	Chitwan	Meghauli	Deepak Gurung			
7	Dang	Ghorahi	Narayan Poudel			
8	llam	llam	Bikash Khanal			
9	Lamjung	Besisahar	Amrit Khanal			
10	Sunsari	Itahari	Khagendra Pokhrel			

Annex 1: Responsible Growers in Different Districts

Annex 2. Data Collection Sheet

सयपत्रीको प्रसोधन उद्योगको लागि परिक्षण उत्पादन Record keeping sheet for Marigold production experiment trail

Name of farmers:	
Address:	
Marigold plant plantation date:	
Planting spacing:	
Application of fertilizers:	
a) Basalb) Top dressb)	•
Flowering starting date:	
Disease and pest seen:	
Treatments:	
No. of Branches each plant:	
1)	
No. of flowers each plant:	
1)	
Weight of a flower:	
1)	
Average weights of flowers each plant:	
1)	

Color of flower petals

.....

Signature of farmers:

.....

Annex 3: Performance of Marigold (Tagetus erecta) cv. African Orange in Different Locations of Nepal Data collection period : 2074 Sawan to Poush

Average weight plants (kg)	2.237	2.289	2.24	2.17	2.145	2.26	2.225	2.152	2.022	2.016	2.1756
Total flower production per plant (kg)	3.39	3.50	3.00	3.34	3.29	3.45	3.38	3.36	3.05	3.21	3.297
Average weight flower (gm)	26.6	27.7	25.4	26.6	26.6	26.8	26.2	27.2	25.6	26	26.47
Average no. of flowers per plants	127.47	126.40	120.53	125.87	124.00	128.80	129.07	123.73	119.47	123.47	124.88
Days to flowering from plantation	53	53	56	54	55	53	54	54	55	53	54
Average height of plant (cm)	63.00	59.00	55.00	63.00	54.00	63.00	55.00	58.00	58.00	59.00	58.7
Average no. branches per plant	18	17.6	16.8	17.6	16.4	17.8	17.8	16.8	16.2	16.8	17.18
Plantation date	4/4/2074	5/4/2074	6/4/2074	4/4/2074	8/4/2074	9/4/2074	9/4/2074	6/4/2074	10/4/2074	15/4/2074	
variety	African Orange										
Location	Chaura	Tamghas	Tarakhola	Panauti	Bharjula	Meghauli	Ghorahi	Illam	Beshisahar	Itahari	
District	Kaski	Gulmi	Baglung	Kavre	Myagdi	Chitwan	Dang	Illam	Lamjung	Sunsari	Average
s. Z	1	2	3	4	5	6	7	∞	6	10	

Annex 4. Photographs



Transplanting



Flower Production



Individual plant and flower production



Flower production



Floriculture Association Nepal Jwagal, Lalitpur