



Research Article

EFFECT OF ENVIRONMENTAL PARAMETER ON DIFFERENT COLOUR MULCHES UNDER SHADE NET HOUSE AND IN OPEN FIELD CONDITION OVER A *CHRYSANTHEMUM* PLANT

TAYADE R.G.^{*1}, TIPRE P.G.², DANDGE A.R.¹, INGLE S.D.², BHAGAT A.K.³

¹Department of Farm Structure, CAET, Jalgaon Jamod, 443402, Dr Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, 444104, India

²Department of Processing and Food Engineering, CAET, Jalgaon Jamod, 443402, Dr Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, 444104, India

³CAET, Jalgaon Jamod, 443402, Dr Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, 444104, India

*Corresponding Author: Email - rgtayade1126@gmail.com

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Abstract: The Shade net is used for controlling the effective parameter of crop growth. Film mulching is an important agricultural practice used to improve crop productivity. Field experiments were conducted in shade net and in open field. They are using *Chrysanthemum* crop to determine the effect of film mulching on soil physical properties and *Chrysanthemum* yield in 2018 and 2019 cropping seasons. The yield of *Chrysanthemum* was increased in shade net than the open field. The experiment was randomized completed using Black mulch (B_p), Silver mulch (S_p), and Transparent mulch (T_p) in shade net and in open field. Film mulching significantly increased the soil temperature and water retention relative to the un-mulched treatments. Yield increases of 60-80% were observed in shade net mulch treatment relative to the control. Shade net can be used to control environment. The size of the bed was taken as 3.04 m x 0.60 m x 0.15 m. *Chrysanthemum* was shade loving plant and grow about 18-30°C and optimum light intensity was required to growth was 180000-300000 lux and relative humidity required 70-90%.

Keywords: Shade net, *Chrysanthemum* Plant, Mulching Paper, LDPE, Shade net

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Introduction

A shade net house is a structure which usually consists of a metal frame that supports shade cloth - a type of screen that provides some passive environmental control e.g., shading the plants from excessive sunlight and wind. A shade house is for maximum growing of indoor, shade loving plants as well as for raising seedlings. In warmer climates shade houses were useful for growing a range of plants that grow well in cool temperate regions but do not cope with the amount of hot direct sun. In a cold snap, more elaborate shade houses could be heated to prevent frost damage to the plants [1]. *Chrysanthemums* are flowering plants of the genus *Chrysanthemum* and they belong to the family of Asteraceae. *Chrysanthemum* is widely cultivated throughout warm temperature, tropical and subtropical countries. It is used in every Indian cuisine due Ornamental use, culinary use, Insecticidal use, and Environmental use. The first man-made plastic was unveiled by Alexander Parkes in 1862 and since, plastics have become common place in our homes, began in 1950s and includes plastic mulches, greenhouse plastic, pots and pug trays, as well as irrigation pipe and tape. Since, its introduction into agriculture plastic has contributed to economic viability of farmers worldwide. For decades farmers had been trying to used various materials such as dry leaf, paddy straw, paddy husk, jowar trash, saw dust, dry grass, dry sugarcane leaves, dry coconut leaves, coconut husk, paper for moisture conservation (reducing water evaporation losses) checking weed growth and moderation of soil temperature, humidity, carbon di-oxide enrichment and increased microbial activity in the soil. Thus, mulching is the process of covering soil around the plant root area with a view to insulate the plant and its roots from the effect of extreme temperature fluctuations [2]. The plastic mulching is a practice of covering the soil surface around the plant to make conditions more suitable for plant growth through In-situ moisture conservation, weed control, better CO₂ exchange foot root system and soil structure maintenance.

Use of dry leaves, straw, hay etc. as a mulching material had been prevalent for ages. However, the introduction of plastic film as mulch increases the efficiency and hence increases in yield. LDPE and LLDPE black plastic mulch film are more popular due to opacity, which check the weed growth under the film. The different colour plastic mulches make different effect on crop growth and pest management. Mulching includes moisture and soil conservation, temperature moderation, salinity and weed control etc. It exerts a decisive effect on earliness, yield and quality of the crop. In mulching, different colour of mulch paper is used to cover the soil bed. The plastic mulch increases yield. Selection of mulch films colour depends upon weed control, rising of soil temperature and cooling down the soil such characteristics [3]. Basically, there are two types of mulches depending upon the material use as a mulching. They are as under,

- 1) Organic mulches
- 2) Inorganic mulches

Organic Mulches

The organic mulches such as crop residues and by product, farm yard manure, and byproducts of timber industry use for mulching, it is known as organic mulching.

Inorganic Mulches

The inorganic materials such as plastic films, when use for mulching is known as inorganic mulches.

- Black Plastic mulch film
- Silver plastic mulch film
- Transparent plastic mulch film

Materials and Method

Experimental site

The experimental site was selected at the field of ICAR-Krishi Vigyan Kendra, Jalgaon Jamod, District Buldhana.

Table-1 Dimensions and other details

Plot size	In shade net	In open field
	12m X 1.5m	12m X 1.5m
Crop taken	<i>Chrysanthemum</i>	
Scientific Name	<i>Dendranthema grandiflora</i>	
Variety	Kirti	
Duration	45 Days	

Experimental setup

Land preparation or deep ploughing and harrowing were carried out by means of tractor drawn M.B. plough and harrow respectively for breaking the clods and cutting the weeds. All the trash of previous weeds was removed from field. Land smoothening and pulverizing of soil was done by rotavator to make the field smooth and approximately level. The water was conveying to the mainline, submain line, laterals, and furrow plots at experimental site. The Irrigation system consisted of mainline, sub-main line, ball valve, laterals, emitters or drippers, grommet and take-off, end cap and accessories such as elbow etc. other material like Plastic film.

Main line

Main line conveyed irrigation water to sub-main. A 3m long polyvinyl chloride (PVC) pipe of 63 mm diameter at 6 kg/cm² pressure was used.

Sub-main line

Sub-mainline conveyed water from main line to the laterals. A polyvinyl chloride (PVC) pipe 63mm diameter was used. The length of submain was 6 m.

Lateral

Laterals 16mm diameter was used to convey the irrigation water from submain to plants through dripper. Pipe made up with low density polyethylene material were used as lateral.

Relative humidity

The relative humidity was measured daily by hygrometer shown in plate

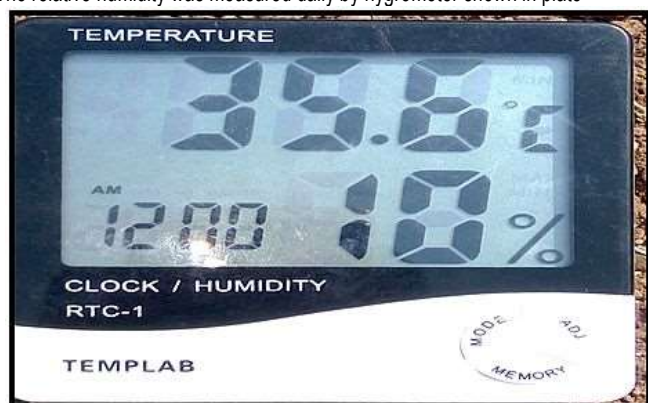


Plate-1 Hygrometer for measurement of temperature and relative, Humidity

Light Intensity

The light intensity was recorded based on the solar radiation measured with digital Lux meter in shade net and in open field conditions, during the experimental study shown in plate



Plate-2 Lux meter for measurement of light intensity

Table-2 Soil temperature (°C) reading in mulches film in shade net at 9-12-3-6 Hrs

Date	Time	Shade net		
		Soil Temperature (°C)		
		Black	Silver	Transparent
01 to 09 Sept. 2018	09:00	30.4	28.8	29.6
	12:00	30.2	29.5	29.9
	03:00	30.7	29.8	29.2
	06:00	29.1	27.9	28.8
10 to 19 Sept. 2018	09:00	28.9	27	27.6
	12:00	29.9	27.4	28.2
	03:00	30.1	27.9	29.1
	06:00	28.9	26.9	27.6
20 to 29 Sept. 2018	09:00	31.1	29.2	30.4
	12:00	30.5	28.4	29.6
	03:00	30.9	28.8	29.1
	06:00	29.5	27.1	28.4
30 to 08 Oct. 2018	09:00	27.7	25.9	26.6
	12:00	28.2	26.5	27.2
	03:00	31.1	27.8	30.4
	06:00	29.6	26.9	28.4
09 to 17 Oct. 2018	09:00	28.4	27.8	28.2
	12:00	29.5	29.1	29.3
	03:00	30.5	30.1	30.2
	06:00	29.6	28.9	29.1

Table-3 Soil temperature (°C) reading in mulches film in open field at 9-12-3-6 Hrs

Date	Time	Open field		
		Soil Temperature (°C)		
		Black	Silver	Transparent
01 to 09 Sept. 2018	09:00	32.2	29.7	30.5
	12:00	32.4	30.3	31.6
	03:00	35.2	32.4	33.7
	06:00	33.3	31.6	32.2
10 to 19 Sept. 2018	09:00	29.1	27.9	28.4
	12:00	30.7	28.4	29.5
	03:00	31.4	29.1	30.2
	06:00	29.4	27.8	28.1
20 to 29 Sept. 2018	09:00	32.1	30.5	31.4
	12:00	32.5	30.2	31.9
	03:00	33.2	31.4	32
	06:00	31.1	29.8	30.4
30 to 08 Oct. 2018	09:00	28.6	27.1	27.9
	12:00	29.4	27.5	28.5
	03:00	32.2	30.4	31.3
	06:00	30	27.3	28.9
09 to 17 Oct. 2018	09:00	29.2	28.5	29.1
	12:00	30.2	29.2	29.5
	03:00	30.7	30.2	30.5
	06:00	29.8	29.6	29.7

Environmental Parameter

The result discussion of environmental parameter study indicates the change in variation of temperature, relative humidity, light intensity, wind speed. All the parameter was measured in shade net and in open field.

Result and Discussion

The comparative study of various plastic films for *Chrysanthemum* crop was taken in shade net and open field. The result and discussion were summarized as follows,

- Environmental Parameter
- Soil moisture content

Temperature variation

The temperature factor was important for the sufficient crop growth. The temperature was measured by soil thermometer. The black plastic film (29.9°C) temperature was highest than the silver film (27.3°C) and (28.3°C) transparent film. So, temperature affects on the plastic film taking at 9-12-3-6 Hrs in 9 day interval at depth at 15cm on the [Table-2] and [Table-3].

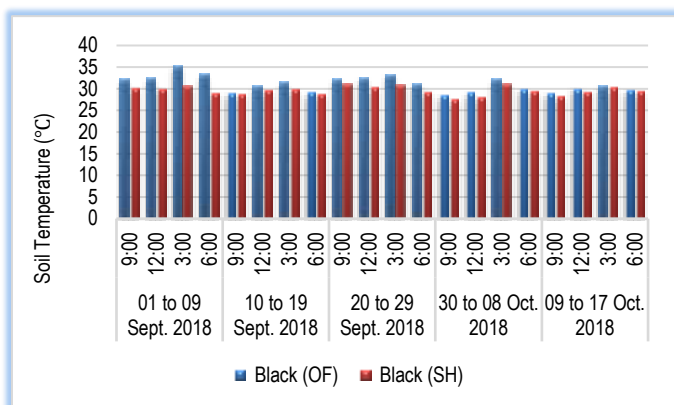


Fig-1 Soil Temperature variation in shade net and in open field inside Black Mulches

The soil temperature of black mulch in open field was higher than the shade net house. The maximum soil temperature of black mulch was observed 35.2°C in open field and the minimum soil temperature of black mulch was observed 27.7°C in shade net shown in the above [Table-2] and [Table-3].

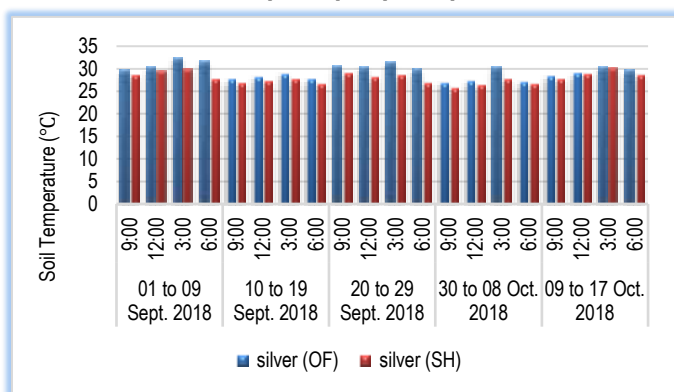


Fig-2 Soil Temperature variation in shade net and in open field inside Silver Mulches

The soil temperature of silver mulch in open field was higher than the shade net house. The maximum soil temperature of silver mulch was observed 32.4°C in open field and the minimum soil temperature of silver mulch was observed 25.9°C in shade net shown in the above [Table-2] and [Table-3].

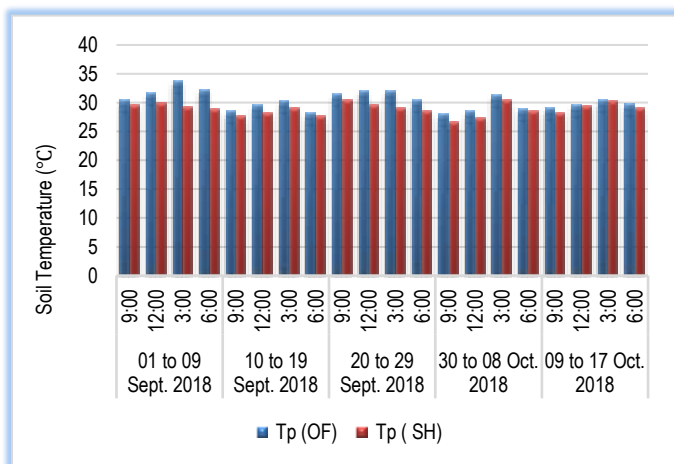


Fig-3 Soil Temperature variation in shade net and in open field inside Transparent Mulches

The soil temperature of transparent mulch in open field was higher than the shade net house. The maximum soil temperature of transparent mulch was observed 33.7°C in open field and the minimum soil temperature of transparent mulch was observed 26.6°C in shade net shown in the [Table-2] and [Table-3].

Relative Humidity, Wind Speed, Light Intensity Variation

The Relative Humidity is amount of water vapour present in air and this has measured by hygrometer in express in percentage (%). Higher relative humidity was observed at per day in shade net than the open field. It depends on climatic variation. Wind speed is a fundamental atmospheric quantity caused by air moving from high to low pressure, usually due to changes in temperature. It is usually measured by anemometer and express in kmph. Generally, wind speed is higher in open field. A plant's most natural habitat provides the intensity of light needed for optimal growth. As a result, different plant types may require different light intensities. Growth of plant was faster in shade net than the open field because shade net cloth reflected the long wave radiation.

Table-4 Relative Humidity, Wind Speed, Light Intensity variation reading in shade net at 9-12-3-6 Hrs

Date	Time	Shade net			
		LI (Klux)	RH (%)	AT (°C)	WV (Kmph)
01 to 09 Sept. 2018	09:00	120	73	28.2	0.6
	12:00	270	69	31.1	0.8
	03:00	300	66	30.5	0.5
	06:00	100	79	28.8	0.4
10 to 19 Sept. 2018	09:00	153	72	28.4	0.6
	12:00	230	68	32.2	0.9
	03:00	270	71	31.5	0.7
	06:00	114	75	27.4	0.5
20 to 29 Sept. 2018	09:00	158	76	29.2	0.7
	12:00	250	70	30.5	0.9
	03:00	290	69	29.2	0.8
	06:00	117	69	28.5	0.7
30 to 08 Oct. 2018	09:00	236	73	29.3	0.3
	12:00	256	75	29.9	0.5
	03:00	275	66	30.4	0.4
	06:00	115	75	28.4	0.3
09 to 17 Oct. 2018	09:00	200	70	29	0.4
	12:00	230	72	29.6	0.5
	03:00	246	65	30.2	0.3
	06:00	165	72	29.1	0.3

Table-5 Relative Humidity, Wind Speed, Light Intensity variation reading in open field at 9-12-3-6 Hrs

Date	Time	Open field			
		LI (Klux)	RH (%)	AT (°C)	WV (Kmph)
01 to 09 Sept. 2018	09:00	353	65	32.2	2.5
	12:00	309	66	33.6	6.8
	03:00	219	59	31.4	3.4
	06:00	127	67	30.2	1.1
10 to 19 Sept. 2018	09:00	250	62	28.5	0.8
	12:00	304	65	32.3	2.4
	03:00	360	68	31.6	2.8
	06:00	122	72	29.2	1.3
20 to 29 Sept. 2018	09:00	373	66	28.9	2.7
	12:00	280	60	31.1	1.5
	03:00	220	61	30.4	2.9
	06:00	121	60	29.5	0.8
30 to 08 Oct. 2018	09:00	396	53	33.7	3
	12:00	270	61	32.3	1.8
	03:00	295	60	30.8	3.9
	06:00	120	55	29.2	0.9
09 to 17 Oct. 2018	09:00	350	65	32.8	2.4
	12:00	280	68	33.1	6
	03:00	290	60	31.2	3.2
	06:00	175	65	30.1	1.5

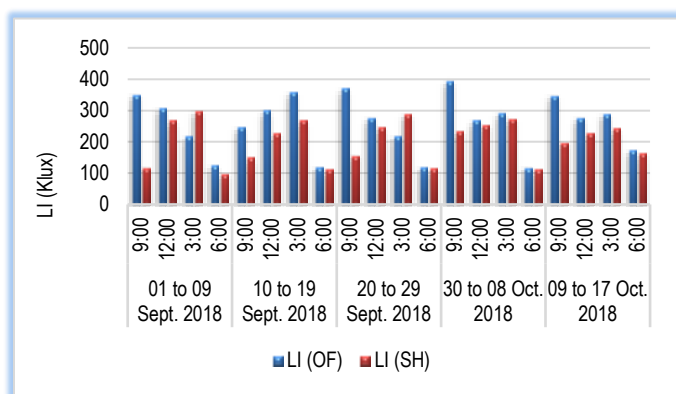


Fig-4 Light Intensity variation in shade net and in open field

The light intensity was higher in open field than shade net. The maximum light intensity was observed at 3 pm and minimum light intensity was observed at 6 pm shown in the above [Table-4] and [Table-5].

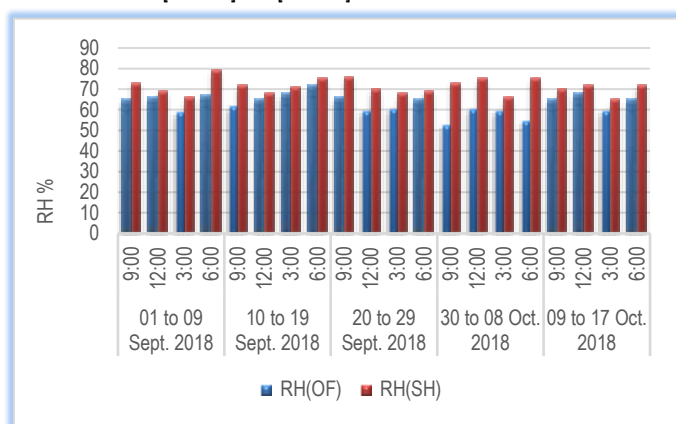


Fig-5 Relative Humidity variation in shade net and in open field

Relative humidity was higher in shade net than open field. The maximum relative humidity was observed 79 % in shade net and the minimum relative humidity was observed 53 % in open field shown in the above [Table-4] and [Table-5].

Table-6 Moisture Content of Black Mulch, Transparent Mulch and Silver Mulch in Shade net

Date	Shade net		
	Black	Silver	Transparent
01-09-2018	16.6	17.1	17.9
11-09-2018	17.2	18.4	19.5
21-09-2018	18.7	19.2	20.8
01-10-2018	20.4	21.1	22.3
11-10-2018	21.7	22.7	23.2

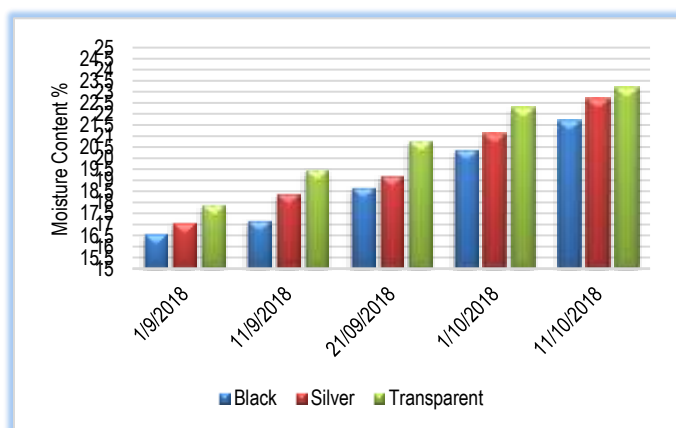


Fig-6 Moisture Content variation of different mulching paper in Shade net House

Soil Moisture Content

The results of the present study indicate the soil moisture content (SMC) was retained under the polyethylene plastic mulch. The silver plastic films have lower soil moisture content than the transparent film. Moisture Content was observed at 45 days after planting in plots covered with black plastic film as compared to the silver plots and clear or transparent mulched plot. But, soil moisture content at 45 days after planting was not black plastic mulch treatment in case flowering crop. This means that black plastic reduced soil water evaporation and thus, helps retain soil water. Moisture content was higher in transparent plastic mulch and lower in black plastic mulch in shade net. The maximum moisture content was observed 23.2 % in transparent plastic mulch in shade net. The minimum moisture content was observed 16.6 % in black plastic mulch in shade net shown in the above table.

Table-7 Moisture Content of Black Mulch, Transparent Mulch and Silver Mulch in open field

Date	Open Field		
	Black	Silver	Transparent
01-09-2018	11.7	12.6	12.9
11-09-2018	12.4	13.9	14.3
21-09-2018	14.1	15.7	15.8
01-10-2018	15.4	16.6	17.2
11-10-2018	16.8	18.1	19.3

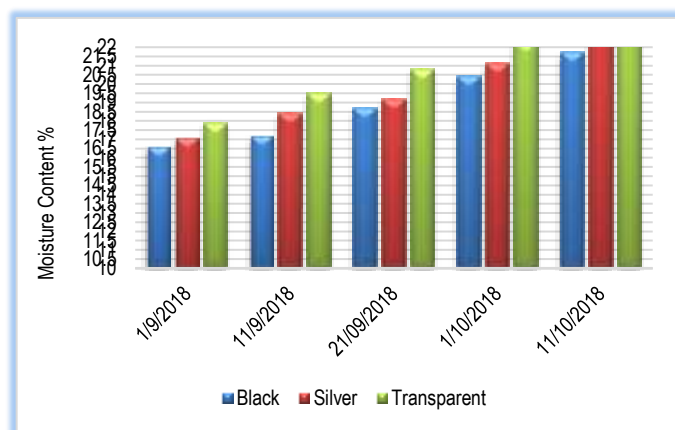


Fig-7 Moisture Content variation of different mulching paper in open field
Moisture content was higher in transparent plastic mulch and lower in black plastic mulch in open field. The maximum moisture content was observed 19.3 % in transparent plastic mulch in open field. The minimum moisture content was observed 11.7 % in black plastic mulch in open field shown in the above [Table-7].

Conclusion

The moisture retention in shade net under the black, silver and transparent was found to be best than the open field. The soil temperature was higher in black plastic mulch than the transparent and silver plastic mulch. The soil temperature in open field was greater than the shade net house. The light intensity, air temperature and wind velocity were higher in open field than the shade net house. Relative humidity was higher in the shade net than the open field.

Application of Research: It was increase flowering production in shade net house as compare to another field. Also retaining moisture and temperature for favourable growth of plants. Also gives flower early than open field condition.

Research category: Agricultural Engineering

Abbreviations:

% : Percent
/ : Per
@ : At the rate of
Agril. : Agricultural
Avg : Average , Rs. : Rupees , Temp. : Temperature

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***Research Guide or Chairperson of research: Mr R. G. Tayade**

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Research project name or number: Effect of different colour mulches in shade net and in open field condition over a *Chrysanthemum* plant.

Author Contributions: All author equally contributed

Author statement: All authors read, reviewed, agree and approved the final manuscript

Conflict of Interest: None declared

Sample Collection: ICAR-Krishi Vigyan Kendra, Jalgaon Jamod, District Buldhana

Cultivar / Variety name: *Chrysanthemum* crop

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

Ethical Committee Approval Number: Nil

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