EFFECT OF IRRIGATION AND PENDIMETHALIN ON WEED CONTROL AND SEED YIELD OF CORIANDER (*Coriandrum sativum* L.)

By

VIJAY PAL PANGHAL

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HISAR

2000

DEDICATED

TO MY BELOVED PARENTS

FOR THEIR

PROFOUND AFFECTION,

INSPIRATION AND

ETERNAL SACRIFICE

CERTIFICATE – 1

This is to certify that this thesis entitled **"Effect of irrigation and pendimethalin on weed control and seed yield of coriander (*Coriandrum sativum* L.)"**, submitted for the degree of Master of Science in the subject of Vegetable Crops to the Chaudhary Charan Singh Haryana Agricultural University, is a bonafide research work carried out by Mr. Vijay Pal Panghal under my supervision and that no part of this thesis has been submitted for any other degree.

The assistance and help received during the course of investigation have been fully acknowledged.

A.C. Yadav
20.10.2010

A.C. YADAV

MAJOR ADVISOR
Scientist
Department of Vegetable Crops
CCS Haryana Agricultural University
Hisar – 125 004

CERTIFICATE – 11

This is to certify that this thesis entitled"**Effect of irrigation and pendimethalin on weed control and seed yield of coriander (*Coriandrum sativum* L.)**", submitted by Mr. Vijay Pal Panghal to the Chaudhary Charan Singh Haryana Agricultural University, in partial fulfillment of the requirement of the degree of Master of Science in the subject of Vegetable Crops, has been approved by the Student's Advisory Committee after an oral examination on the same.

kk. Thakral. 25/1/2021
CO- MAJOR ADVISOR

A-C-Yadav 25.01.2021
MAJOR ADVISOR

25/1/2021
HEAD OF THE DEPARTMENT

DEAN, POST-GRADUATE STUDIES

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CHAPTER –1

INTRODUCTION

From time immemorial India has been recognised the world over as the home of the spices. Once considered a luxury, spices have today become an integral part of our daily diet. Indian spices are widely used to flavour food and beverages, for meat preservation, medicinal preparation, cosmetics, perfumery, bakery goods and various other products.

Among the spices, coriander (*Coriandrum sativum* L.) is one of the most important winter season seed spice and belongs to the family Umbelliferae. It's nutritive value is high. All parts of coriander plants i.e. tender stem, leaves, flower and fruits have a pleasant aromatic odour and being used for various purposes. The leaves are used for flavouring soups, curry, sauce etc. the seeds are an important ingredient of curry powder in India.

In India, coriander is grown commercially in Andhra Pradesh, Tamil Nadu, Karnataka, Rajasthan and Madhya Pradesh. Its fruits produced in India are largely consumed within the country. However, there is a great scope of export to U.K., U.S.A., Swedon, Malaysia, Sri Lanka, France and Kenya. India produced about 2.6 million tonnes of spices during 1998-99 from 2.3 million hectares. Area and production under coriander during 1997-98 was

5.2 lakh ha and 3.08 lakh tonnes, respectively (Ghosh *et al.*, 1999). Recently the Indian government has taken steps to increase the production of spices including coriander to fill up the gap between production and export.

The cost of coriander cultivation is low as the requirement of inputs are less. It can be cultivated on marginal soils. The climatic conditions of Haryana are conducive for coriander cultivation, yet its cultivation is restricted to few pockets only. The restricted cultivation is possibly due to the lack of information on cultural requirement for growing it successfully. The frequency of irrigation and weed management is the most important agronomic aspect that plays an important role in exploiting the yield potential of the crop. Obviously water is the most important input. Judicious use of water, therefore, is the prime factor for better yield and quality. Weeds compete heavily with the crop plant, mainly for the nutrients, water, light and space leading to heavy losses in yield and quality depending upon intensity of infestation.

Keeping the above factors in mind, the present study was, therefore, undertaken with the following objectives:

1. Effect of irrigation on growth, seed yield and quality of coriander.
2. To work out the optimum dose of pendimethalin in coriander seed crop.
3. To optimise irrigation for seed production of coriander.

CHAPTER –2

REVIEW OF LITERATURE

In this chapter an attempt has been made to review the information available on the influence of irrigation and pendimethalin on weed control, seed yield and quality of coriander. As the work on the above mentioned aspects on this crop is meagre, therefore, where it was felt necessary, work done on these aspects in some other crops related to the present study has been included.

2.1 EFFECT OF IRRIGATION

Plant growth and survival is associated with the water availability. Any degree of water imbalance will produce a proportionately deleterious deviation in physiological activity, growth and production. Scientific irrigation scheduling is a technique for determining the proper time and quantity of irrigation water. The major objective of irrigation scheduling is to avoid water deficit in crop plants and to obtain optimum yield under a particular agroclimatic conditions. Climatological approach, soil water regime and plant indices including the critical growth stage concept is commonly used criteria for scheduling of irrigation.

Lal *et al.* (1998) indicated that to grow a profitable seed crop in the Agra region, coriander should be irrigated before flowering and during seed filling stages. Lal *et al.* (1997) reported that, beside pre sowing irrigation, two irrigation applied at pre-flowering and during seed filling produced higher seed yield of coriander than the post sowing irrigation or one irrigation at the six leaves or peak flowering stages. Singh and Rao (1994) observed highest seed yield of coriander (2366 Kg/ha) from 480 mm of irrigation water. Tomar *et al.* (1994) revealed that coriander plants gave 46 per cent higher seed yield when irrigated at branching, flowering and seed filling stages as compare to one irrigation applied at branching stage. Ali *et al.* (1994) observed higher seed yield of coriander from 4 irrigations given at early leaf, branching, flowering and seed formation stages. According to Hornok and Csaki (1987), yield of coriander and anise increased with irrigation. Pareek and Sethi (1985) while working on coriander at New Delhi reported that seed yield raised from 9.08 q/ha (two irrigations) to 12.03 q/ha (four irrigations). Khashmelmous (1984) revealed that irrigation intervals of 5, 8, 11 and 14 days did not have any significant effect on plant growth, seed yield, test weight and seed dry matter content of coriander.

Jangir and Rajender Singh (1996) obtained higher seed yield of cumin cv. RZ 19 from 5 irrigations applied at sowing, 10, 30, 55 and 80 DAS. Patel *et al.* (1991) reported that under 0.60 IW: CPE ratio, highest number of umbels per plant and seed yield of cumin was obtained as compared to 0.30

and 0.45 IW:CPE ratio. Niazi and Aness (1970) while working on cumin reported that a single irrigation just before flowering increased yield by an average of 21.6 per cent and an additional irrigation after flowering increase to 31.8 per cent.

Yadav *et al.* (1998) while working on fennel observed that consumptive use of water, seed yield and biological yield were increased with increase in the number of irrigations and was highest when irrigation was applied at crown stage, main umbel development stage and seed setting stage. They also further reported that irrigation treatment did not influence seed quality character like germination percentage, electrical conductivity and field emergence index. Patel *et al.* (1988) reported that on clay soil of south Gujrat, the highest average seed yield of fennel (297 Kg/ha) was obtained from plot irrigated to a depth of 60 mm at IW:CPE ratio of 0.90. Sharma and Prasad (1990) observed that irrigation at 0.6 IW/CPE resulted in a higher seed yield of fennel (2020 Kg/ha) than that obtained at 0.4 IW/CPE (1910 Kg/ha). They also concluded that irrigation at 0.8 IW/CPE did not give any increase in yield over the 0.6 IW/CPE treatment.

Singh and Thakral (1995) at Hisar, observed the highest seed yield of fenugreek var. Pusa Early Bunching at 1.0 IW : CPE ratio followed by 0.8 IW : CPE ratio. Shain and Colovkina (1982) recorded higher yield of fenugreek seed when soil moisture was kept at 60 to 80 per cent of field capacity during bud development.

2.2 EFFECT OF PENDIMETHALIN

Since very little information with regards to the effect of pendimethalin in coriander seed crop is available therefore, literature available on other related crops is also presented.

Zheljazkov and Zhalnov (1995) obtained highest yield of coriander seed crop when treated with pendimethalin. Pre-emergence application of pendimethalin @ 1.5 Kg/ha had the least effect on coriander population and vigour and gave effective weed control (Mitchell*et al.*, 1994). Thakral *et al.* (1989) evaluated the different herbicides (alone and in combination) in coriander seed crop. They recorded the maximum seed yield of coriander in weed free treatment followed by pendimethalin and fluchloralin each at 1.5 Kg/ha.

Bhati (1993) observed that fluchloralin, terbutryn, pendimethalin and oxadiazon all at 0.5-1.0 Kg/ha, increased cumin seed yield over untreated control. Rathore *et al.* (1990) concluded that the best weed control and best cumin seed yield (1.76 q/ha) was achieved with pendimethalin at 1.0 Kg/ha. Mustafee (1990) while working on cumin cv. MC-43 reported that pendimethalin at 0.75 Kg/ha + irrigation at two days after sowing gave best weed control and the highest seed yield (239 Kg/ha). Parihar and Jangir (1989) at Mandor, Rajasthan observed that pre-emergence application of pendimethalin @ 1.0 Kg/ha followed by one manual weeding recorded 56.78 per cent higher seed yield of cumin than two conventional manual weeding

(569 Kg/ha). They also reported that pendimethalin without hoeing produced seed yield 819 Kg/ha. Patel & Mahta (1989) indicated that pendimethalin and fluchloralin with or without one hand weeding were effective in controlling weeds in cumin and found pendimethalin at 0.5 Kg/ha, the most economic treatment. Kavani *et al.* (1989) in cumin seed crop observed that application of pendimethalin at 0.5 Kg/ha was most effective in controlling *Chenopodium album* up to harvest. Maliwal and Gupta (1988) obtained highest seed of fenugreek in weed free check (10.56 q/ha) followed by hoeing twice (10.23 q/ha). Pendimethalin at 0.75 Kg/ha gave seed yield 8.91 q/ha. Maliwal (1987) found that pre-emergence application of pendimethalin (0.75 Kg/ha) proved the most effective herbicide in fenugreek. Similar results have also been reported by Mali and Suwalka (1987) with pre-emergence application of pendimethalin at 0.75 Kg/ha + hoeing. Mali *et al.* (1987) obtained the highest seed yield from weed free and hand weeded control, followed by pendimethalin at 0.75 Kg/ha + hoeing in fenugreek.

CHAPTER –3

MATERIAL AND METHODS

The study entitled, "Effect of irrigation and pendimethalin on weed control and seed yield of coriander" was conducted at the Vegetable Research Farm and in the Laboratories of the Department of Vegetable Crops of College of Agriculture in the Chaudhary Charan Singh Haryana Agricultural University, Hisar during winter season of 1999-2000.

The details of the procedures followed, criteria used for treatment evaluation and methods adopted during entire course of investigation are presented in this chapter.

3.1 LOCATION

The research area of CCS Haryana Agricultural University, Hisar is situated in subtropical climate zone at 29°10′ latitude North and 75°46′ longitude East at an elevation of 215.2 metres above mean sea level.

3.2 CLIMATE

This tract is characterized by the semi-arid climate with hot and dry summer, extremely cold winter and humid warm monsoon. The maximum and minimum temperature show vide degree of fluctuations during summer and winter months. The maximum temperature of 43-47°C during summer

and minimum temperature below freezing point accompanied by frost may be recorded in January. The rainfall is unevenly distributed throughout the year. Most of the rains are received during monsoon months from July to September along with few showers during winter and spring seasons. The average rainfall of the area is about 40 cm per annum.

The meteorological data for the crop season are recorded for the minimum and maximum temperature, total rainfall and pan evaporation (United State Weather Bureau class A pan Evaporation) at the Meteorological Observatory located in Agronomy Research Area of University Farm, Hisar.

3.3 SOIL

Soil of the area are derived from Indo-Gangetic alluvium, which are very deep and sandy loam in texture.

Five representative soil samples were taken from different places in the experimental field from 0-25 cm depth before sowing of the crop. Composite soil samples were prepared by passing soil through a 2 mm mesh sieve and were analysed for various physico-chemical properties of the soil (Table 2).

3.4 PHYSICAL CONTENTS OF THE SOIL

The important soil physical contents of the experimental plot are given in Table 1.

Table 1. Physical content of the soil

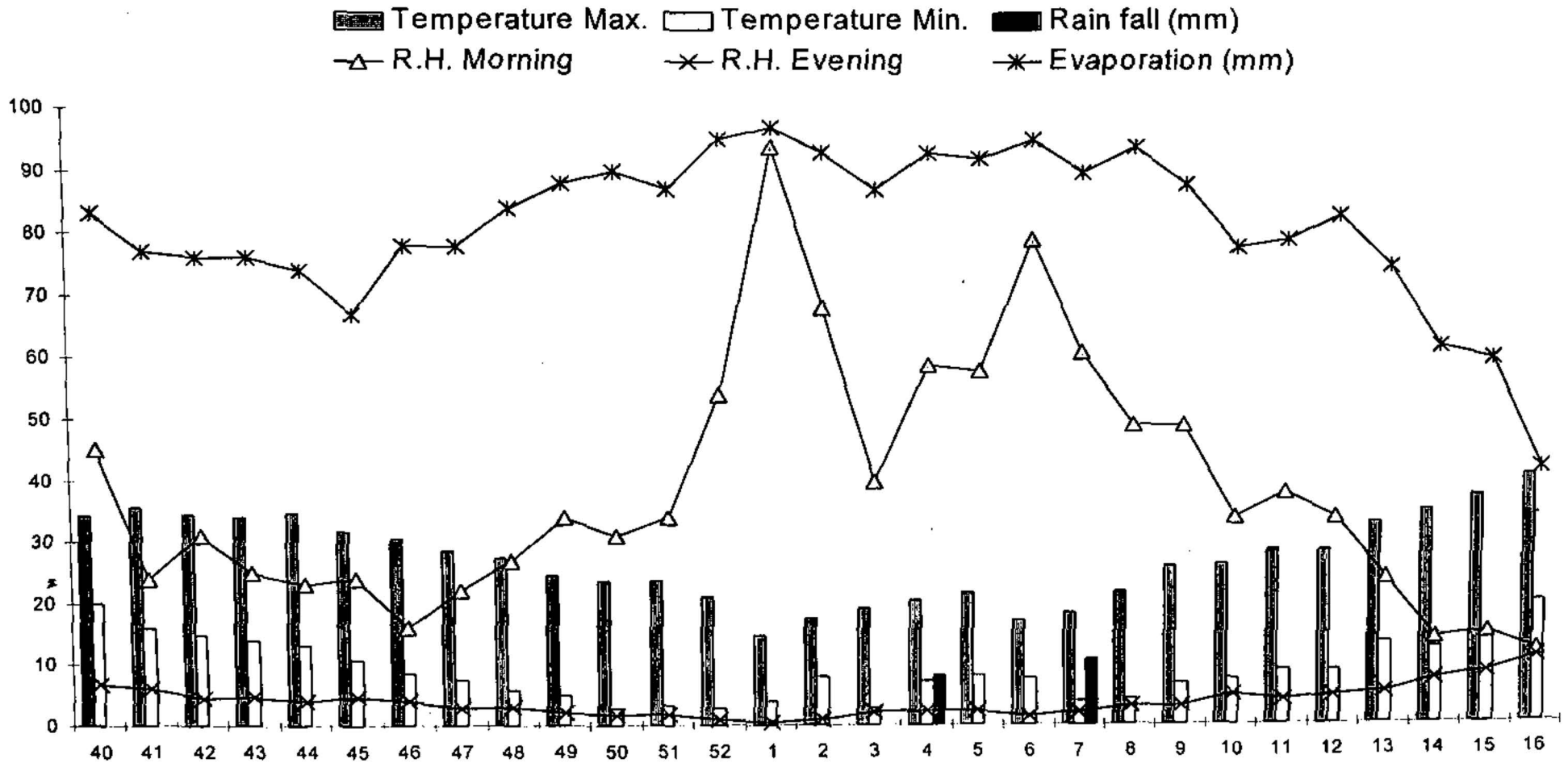
Content	Depth of soil surface (cm)				Method used
	0-25	25-50	50-75	Mean	
Field capacity (moisture %)	18.31	18.92	18.42	18.55	Pressure Membrane Apparatus (Richard and Weaver, 1943)
Permanent wilting point (moisture %)	7.96	7.59	7.52	7.69	
Bulk density (g/cc)	1.45	1.48	1.51	1.48	Core sampling Method (Bodman, 1942)

Table 2. Mechanical and chemical composition of the soil experimental field.

Component	Soil depth (0-25 cm)
Mechanical Analysis	
Fraction	
Sand	70.2
Silt	16.3
Clay	13.5
Chemical Analysis	
Organic carbon (%)	0.33
Available Nitrogen (Kg/ha)	151.2
Available P (Kg/ha)	10.35
Available K (Kg/ha)	328.7
PH	7.7
EC (dS/m at 25°C)	0.48

3.5 MECHANICAL ANALYSIS OF THE SOIL

The soil was analysed for different fractions of soil separates by the International Pipette Method (Piper, 1950). On the basis of fractional analysis the soil is categorised as sandy loam in texture.



Mean Weekly Meterological Data during the Crop growing Season

Organic carbon, available nitrogen, phosphorus, potash, pH and EC were determined by Walkley and Black's Method (Piper, 1950). Alkaline permanganate method (Subbiah and Asija, 1956). Olsen's method (Olsen *et al.*, 1954), Flame photometric method, pH meter with glass electrode (Piper, 1950) and conductivity bridge method, respectively.

The data in Table 2 indicated that the soil of the experimental plot was low in organic carbon and nitrogen, medium in phosphorus and rich in potash with slightly alkaline in reaction.

3.6 EXPERIMENTAL DETAILS

The details of experiment "Effect of irrigation and pendimethalin on weed control and seed yield of coriander var. Hisar Anand " is given below :

Treatments

A. Main plot treatments (Irrigation levels = 4)

Irrigation levels	**Interval of irrigation (DAS)**
I_1	30, 90
I_2	30, 60, 120
I_3	30, 90, 120
I_4	30, 60, 90, 120

B. Sub plot treatments (Weed control treatments = 4)

W_1	Weedy check
W_2	Weed free
W_3	Pendimethalin at 1.0 Kg/ha
W_4	Pendimethalin @ 1.5 Kg/ha
Design	Split plot
Replication	Three
Plot size	3.4 m x 3.2 m
Depth of irrigation	5 cm
Variety	Hisar Anand

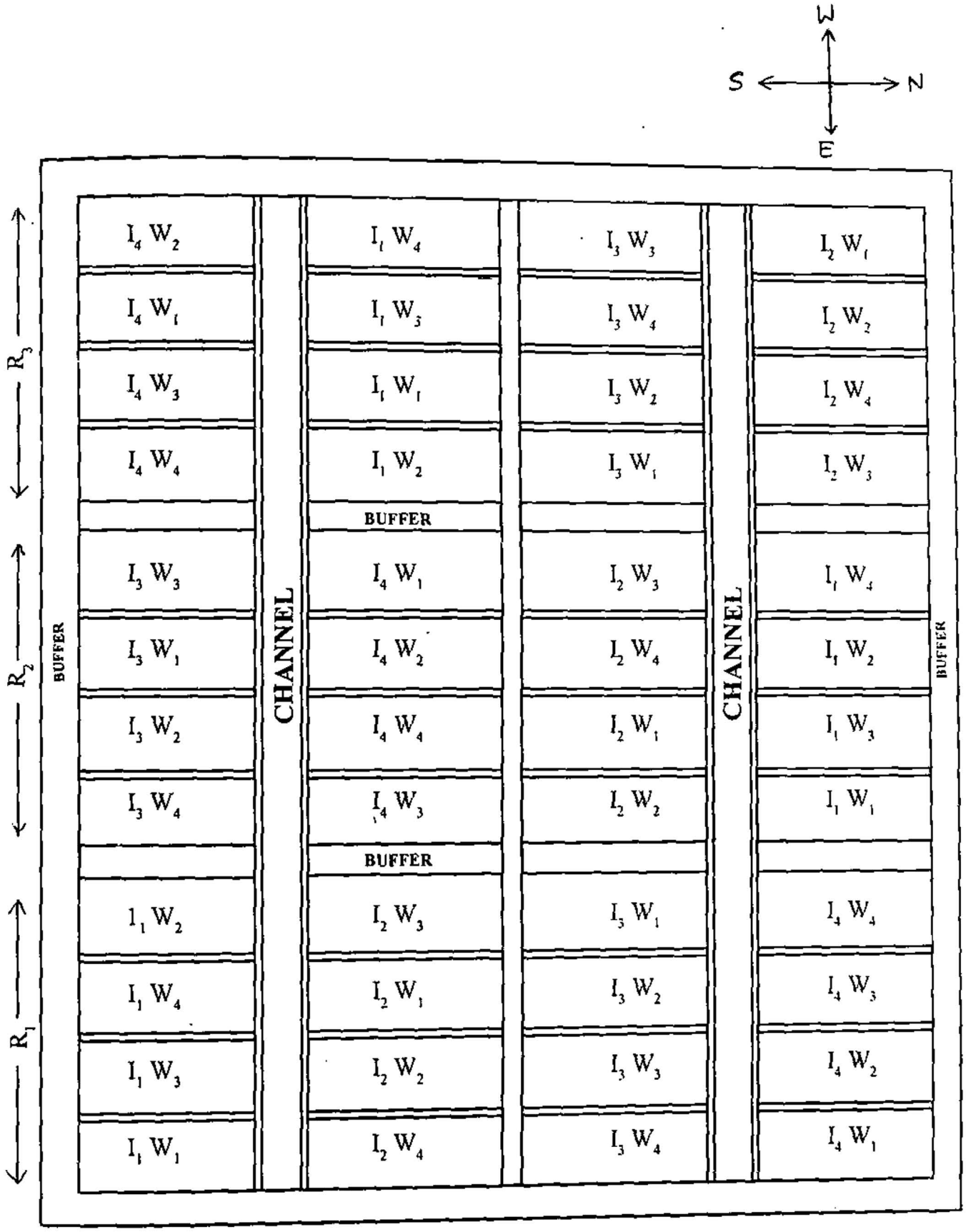


Fig.2: LAYOUT PLAN OF EXPERIMENTAL FIELD

3.6.1 Irrigation

The crops were sown with a pre-sowing irrigation of about 8 cm depth. The subsequent post-sowing irrigations were applied at various days of interval (Table 3). The depth of post-sowing irrigation were kept 5 cm.

Table 3. Dates of irrigation at various days of interval of crop growth

Interval of irrigation (DAS)	30	60	90	120
Dates	9.12.1999	8.1.2000	7.2.2000	9.3.2000

3.6.2 Weed control

In weedy check plots (W_1), there was no weeding after sowing of the crop. In weed free plots (W_2), weeds are removed manually whenever they are seen in the plots. In W_3 and W_4 treatment plots, there was application of pendimethalin at 1.0 Kg and 1.5 Kg /ha, respectively after three days sowing of crop as pre emergence application.

3.7 CULTURAL OPERATIONS

The field was prepared by three harrowing and plankings. The recommended dose of 60 Kg N and 40 Kg P_2O_5 /ha were applied at the time of field preparation. The remaining 30 Kg N was applied after two month of sowing. The seed was sown in rows 30 cm apart and thinning was done when plant attained a height of 10 cm and bearing 3-4 leaf to keep the distance between plants at 20 cm. The timely cultural operations like weeding, hoeing

etc. (only in W_2 treatment) and insect-pest control particularly aphid were followed as and when required during the entire course of experimentation.

3.8 OBSERVATIONS RECORDED

3.8.1 Growth studies

3.8.1.1 Plant height

Plant height was measured from ground level to the top of highest umbel in centimeters at the time of harvesting of ten randomly selected plants of each plot and averaged.

3.8.1.2 Number of primary branches per plant

The branches emerged from the main shoot of ten randomly selected plants of each plot were counted at the time of harvesting and averaged.

3.8.1.3 Days taken to flowering in 50 per cent plants

The number of days from the date of sowing to flowering in five of the ten tagged plants in main umbel were taken as days to 50 per cent flowering.

3.8.2 Yield studies

3.8.2.1 Seed yield per plant

Seed yield of the each plot weighed and divided by total number of plants represented the seed yield per plants in gram.

3.8.2.2 Seed yield

The seed yield of all the plants in each plot was weighed to obtain the seed yield per plot which was later converted to seed yield per hectare.

3.8.2.3 Biological yield

The total above ground biomass of all the plants in each plot on dry weight basis was weighed to calculate the biological yield per plot which was later converted to biological yield per hectare.

3.8.2.4 Harvest index

It is the economic yield expressed as percentage of biological yield and calculated as following (Donald & Hamblin, 1976)

$$\textbf{Harvest index} = \frac{\text{Economic yield}}{\text{Biological yield}} \times 100$$

3.8.3 Quality studies

3.8.3.1 Standard seed germination (%)

Fifty seeds of each treatment in each replication were placed on top of paper in the petri dishes for germination test at a temperature of 25°C ± 1 with 90-95 per cent relative humidity in the germinator. First count was taken after 6 days and final count was taken after 21 days, the observation were recorded for seed germination and was later converted into seed germination percentage.

3.8.3.2 Test weight

From the sample drawn from each plot, 1000 seed were counted without discrimination for its size and appearance and weighed to record test weight in gram.

3.8.3.3 Seed vigour

The total length of ten randomly selected seedlings from each treatment in each replication in centimeters were recorded at the time of final count (21 days of germination) and averaged. The averaged length were multiplied with the standard germination of the same treatment and calculated the seed vigour.

Seed vigour = Total length of seedling **X** Standard Germination per cent

3.8.4 Soil moisture studies

Soil moisture content of different soil depth i.e. 0-25, 25-50 and 50-75 cm was determined by gravimetrically at sowing, before and after each irrigation and at harvest using following formula :

$$\textbf{Soil moisture content (\%)} = \frac{\text{Weight of moisture}}{\text{Weight of dry soil}} \text{ X } 100$$

3.8.4.1 Consumptive use of water

Consumptive use of water was calculated for different treatments by summing up the moisture use values for different periods. The rainfall received during the period was also added to the moisture use of the corresponding period. The following equation as given by Dastane (1972) was used for computing consumptive use of water.

$$\textbf{Cu} = EP \text{ X } 0.8 + \sum_{i=1}^{n} \ldots \frac{M1i - M2i}{100} \text{ X } dbi \text{ X } Di + ERF$$

where, Cu = Consumptive use (cm) of water

EP = Pan evaporation value (mm) from USWB class A pan for

the interval from date of irrigation to the sampling after irrigation.

0.8 = A constant factor used to get Et value by multiplying EP value for a given period.

M1i =Per cent soil moisture (oven dry basis) of the ith layer on the day when sampling in irrigated soil is possible.

M2i =Per cent soil moisture (oven dry basis) of the ith layer on the date of sampling just before subsequent irrigation.

n = Number of soil layers.

dbi = Bulk density of the ith soil layer (g cm^{-3})

Di = Depth (cm) of the ith layer of soil.

ERF= Effective rainfall (mm), if any during the period of consideration.

The ground water contribution was considered nil as the water table remained below the root zone during the crop season.

3.8.4.2 Water use efficiency

Water use efficiency of different treatments were calculated by the following formula.

$$\textbf{Water use efficiency} = \frac{\text{Yield of seed (Kg/ha)}}{\text{Consumptive use of Water (mm)}}$$

3.8.5 Weed studies

3.8.5.1 Weed population

Number of weeds was counted at 80 and 120 DAS of the crop. Weeds were counted with the help of a quadrant measuring 0.25 sq.m. by placing randomly at 4 places in each plot.

3.8.5.2 Dry weight of weeds

Total weeds for 0.25 sq.m. area after 80 and 120 DAS were first sun dried and then dried in an oven at 60°C to constant weight.

3.9 STATISTICAL ANALYSIS

The data presented in this thesis are the mean values of different measurements. The statistical methods described by Panse and Sukhatme (1961) and Cochran and Cox (1950) followed for statistical analysis and interpretation of the experiment result. In order to evaluate the comparative performance of the various treatments, the data were analysed by the technique of analysis of variance described by Fisher (1950). As usually done all the test of significance were made at 5 per cent level of significance.

3.10 ECONOMIC ANALYSIS

3.10.1 Monetary returns

Cost of cultivation of crop was calculated and then additive cost of each of the treatment was calculated by taking into account all the items as per standard procedure and prevailing market rates and both were added to get total cost of cultivation of each treatment and the produce i.e. grain yield was converted into gross return at the market rate and the net return for each treatment was calculated by subtracting the cost of cultivation for respective treatment combination.

CHAPTER –4

EXPERIMENTAL RESULTS

The results of the experiment conducted under the title "Effect of irrigation and pendimethalin on the weed control and seed yield of coriander var. Hisar Anand", during the winter season of 1999-2000 are presented in this chapter.

4.1 GROWTH STUDIES

4.1.1 Plant height

The data on the plant height in the Table 4 revealed that the maximum plant height (98.18 cm) was recorded when the crop received four irrigations at an interval of 30, 60, 90 and 120 DAS (I_4) followed by three irrigations at interval of 30, 60 and 120 DAS (I_2). The height recorded under I_2 treatment was at par with I_3 treatment. Minimum plant height of 88.87 cm was observed when the crop was irrigated at 30 and 90 DAS (I_1).

Weed control treatments also influenced the plant height. The maximum plant height (96.27 cm) was recorded in weed free treatment (W_2) which was at par with W_4 treatment in which pendimethalin was applied @ 1.5 Kg/ha. The minimum plant height (87.22 cm) was observed in weedy check i.e. in W_1.

No significant differences were observed between two pendimethalin doses i.e. 1.0 and 1.5 Kg /ha.

4.1.2 Number of primary branches per plant

The number of primary branches per plant as affected by different treatments is presented in Table 4. The maximum number of primary branches per plant (7.80) were observed when four irrigations at 30, 60, 90 and 120 DAS were applied (I_4). Number of branches in I_2 treatment were found statistically similar to those of I_4. The minimum number of primary branches per plant (6.00) were observed when two irrigations were given (I_1).

The weed free treatment i.e. W_2 provided the maximum (7.87) number of primary branches per plant which was statistically at par with pendimethalin at 1.5 Kg /ha. The minimum branches per plant (4.87) were observed in weedy check.

4.1.3 Number of umbels per plant

Table 5 clearly indicates that, the number of umbels per plant were recorded maximum (25.47) when maximum number of irrigations were applied (I_4 treatment) and umbels were found minimum (18.57) when two irrigations were applied in I_1 treatment.

Obviously, weed free treatment produced the maximum (25.43) umbels per plant. Pendimethalin 1.5 Kg /ha also provided the similar number of umbels per plant as were produced in weed free treatment. Weedy check produced the minimum number of umbels per plant (13.66).

Table 4. **Effect of irrigation levels and Weed control treatments on plant height and number of primary branches per plant.**

Irrigation levels	Plant height at harvest (cm)	Number of primary branches per plant
I_1	88.87	6.00
I_2	93.33	7.20
I_3	91.60	6.62
I_4	98.18	7.80
C.D. at 5 % level	**2.54**	**0.64**
Weed control treatments		
W_1	87.22	4.87
W_2	96.27	7.87
W_3	93.84	7.25
W_4	94.65	7.62
C.D. at 5 % level	**1.72**	**0.34**

4.1.4 Days to 50 per cent flowering

Table 5 revealed that plant took more days to flower (105.20) in I_4 where four irrigations were applied which was followed by I_2 treatment. The minimum days (101.37) were taken to bloom when two irrigations at 30 and 90 days after sowing (I_1).

Weedy check (W_1) took more days to bloom (104.67) which was followed by pendimethalin @ 1.0 Kg /ha (W_3). Weed free treatment i.e. W_2 took minimum (101.92) days to bloom.

A perusal of data of interaction presented in Table 6 revealed that the maximum number of days to flowering (107.00) were taken by the plants which were given 4 irrigations (I_4) where no weeds were removed (W_1). This was followed by I_2W_1 and I_4W_3 combinations which took 105.30 days to flower in 50 per cent plants. The plants which were given only two irrigations (I_1) and were kept in weed free (W2) took minimum days (100.30) to flower in 50 per cent plants. I_1W_4 combination also took statistically similar number of days as that of I_1W_2.

4.2 YIELD STUDIES

4.2.1 Seed yield per plant

The data pertaining to seed yield per plant are presented in Table 7. Maximum seed yield of 9.60 g per plant was recorded with the application of four irrigations at an interval of 30, 60, 90 and 120 DAS (I_4) which was statistically at par with I_2 treatment where the crop was irrigated at 30, 60 and

Table 5. **Effect of irrigation levels and Weed control treatments on total number of umbels per plant and days to 50 per cent flowering.**

Irrigation levels	Number of Umbels/plant	Days to 50 per cent flowering
I_1	18.57	101.37
I_2	22.73	103.00
I_3	21.12	102.31
I_4	25.47	105.20
C.D. at 5 % level	**1.39**	**0.55**
Weed control treatments		
W_1	13.66	104.67
W_2	25.43	101.92
W_3	23.92	103.05
W_4	24.88	102.23
C.D. at 5 % level	**1.21**	**0.51**

Table 6. **Interactive effects of irrigation levels and Weed control treatments on days to 50 per cent flowering.**

Treatment	Weed control treatments				
	W_1	W_2	W_3	W_4	Mean
Irrigation levels					
I_1	103.40	100.30	101.20	100.60	101.37
I_2	105.30	102.00	103.00	101.70	103.00
I_3	103.00	101.20	102.70	102.33	102.31
I_4	107.00	104.20	105.30	104.30	105.20
Mean	104.67	101.92	103.05	102.33	

CD at 5 % level

i.	Irrigation levels	0.55
ii.	Weed control treatments	0.51
iii.	Irrigation levels x Weed control treatments	1.01

120 DAS. Minimum seed yield per plant (6.21) was observed under I_1 irrigation level where two irrigations at 30 and 90 DAS were given which was statistically at par with I_3 treatment.

Weed control treatments also affected the seed yield per plant and was found maximum (9.35 g) in weed free treatment (W_2). No significant differences were observed between pendimethalin 1.0 Kg and 1.5 Kg /ha (W_4). Weedy check produced the minimum seed yield (5.49 g) per plant.

4.2.2 Seed yield (q/ha)

The data recorded on seed yield per hectare are also presented in Table 7. The seed yield increased with the each increase in number of irrigations. The highest seed yield (15.00 q/ha) was obtained with the application of four irrigations at an interval of 30, 60, 90 and 120 DAS, which was found statistically superior over all other treatments except I_2 where three irrigations at 30, 60 and 120 DAS were given. However, no significant difference were observed for seed yield between I_2 and I_3 treatment. The minimum seed yield (9.71 q/ha) was obtained under I_1 irrigation level.

Regarding weed control treatment, pendimethalin at 1.5 Kg /ha gave 13.86 q/ha seed yield which was found statistically similar to that of pendimethalin at 1.0 Kg /ha. Weed free treatment (W_2) gave the highest (14.62 q/ha) seed yield, the minimum seed yield per hectare (8.54 q) was recorded under weedy check treatment (W_1).

Table 7. **Effect of irrigation levels and Weed control treatments on seed yield.**

Irrigation levels	Seed yield/plant (g)	Seed yield (q/ha)
I_1	6.21	9.71
I_2	8.28	12.94
I_3	7.61	11.85
I_4	9.60	15.00
C.D. at 5 % level	**1.48**	**2.32**
Weed control treatments		
W_1	5.49	8.54
W_2	9.35	14.62
W_3	7.98	12.48
W_4	8.87	13.86
C.D. at 5 % level	**1.26**	**1.97**

FIGURE 3 : EFFECT OF IRRIGATION LEVELS ON SEED YIELD

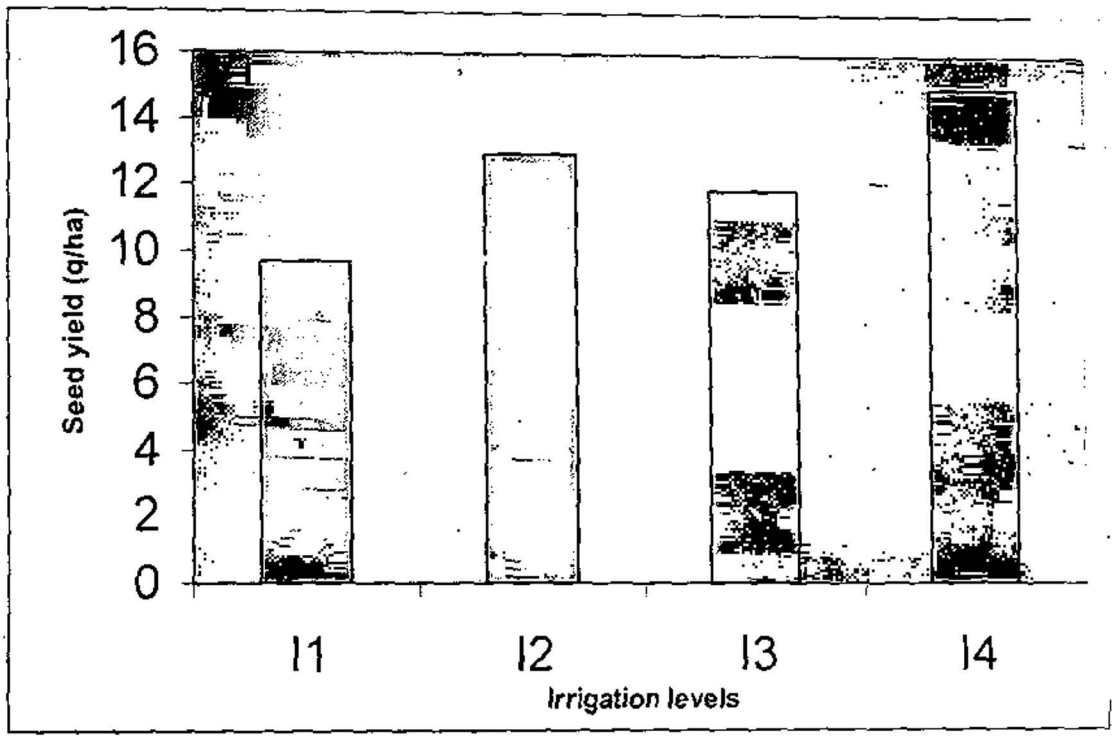
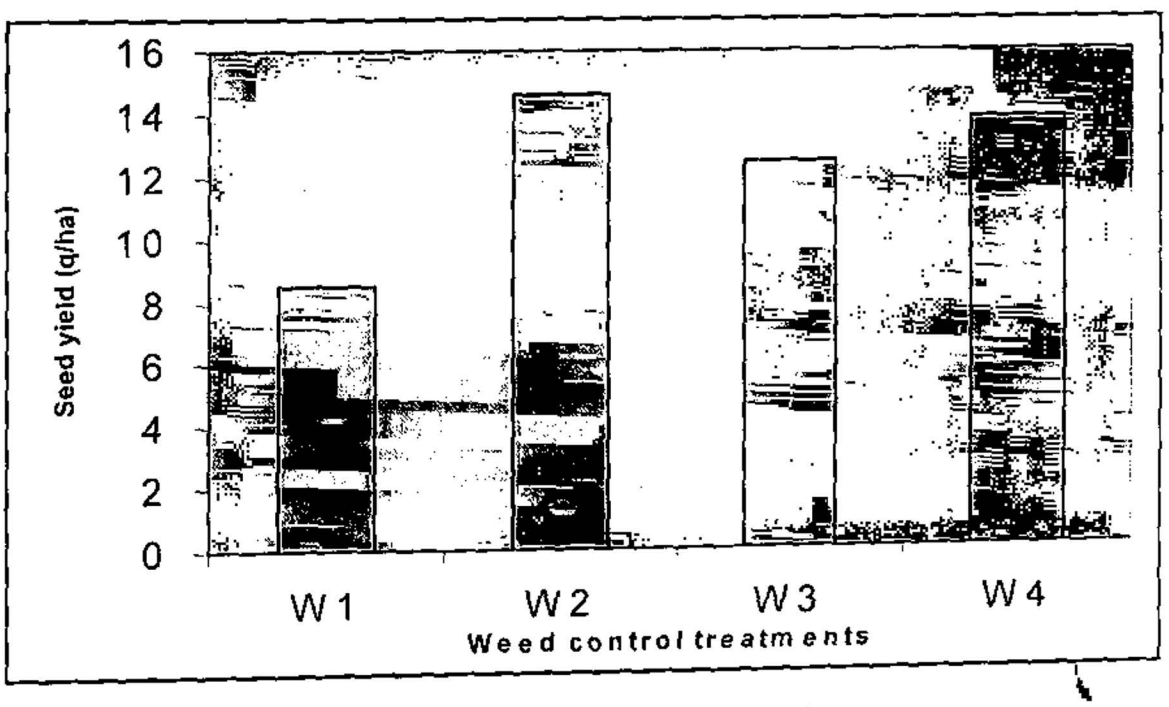


FIGURE 4 : EFFECT OF WEED CONTROL TREATMENTS ON SEED YIELD (Q/HA)



4.2.3 Biological yield

Table 8 shows that the biological yield was recorded highest (60.37q/ha) with the maximum number of four irrigations (I_4). However, I_2 treatment produced statistically same biological yield as that of I_4. Between I_2 and I_3 treatments also no significant differences were observed. The minimum biological yield (40.05 q/ha) was produced by I_1 i.e. where two irrigations were applied during entire growing season.

Regarding weed control W_2 and W_4 treatments i.e. weed free treatment and pendimethalin 1.5 Kg /ha gave statistically similar and maximum biological yield. No significant differences were observed between the two pendimethalin doses i.e. W_3 and W_4 treatment The minimum biological yield (36.57 q/ha) was obtained where no weeds were removed (W_1).

4.2.4 Harvest index

Different levels of irrigation could not influence the harvest index (Table 8). However, the maximum harvest index 24.84 per cent was recorded under I_4 treatment and the minimum under I_1.Various weed control treatments also did not influence the harvest index.

4.3 QUALITY STUDIES

4.3.1 Test weight

The data pertaining to 1000 seed weight have been presented in Table 9. Maximum test weight (17.16 g) was found under I_4 irrigation level which received four irrigations at 30, 60, 90 and 120 days after sowing followed by

Table 8. **Effect of irrigation levels and Weed control treatments on biological yield and harvest index.**

Irrigation levels	Biological yield (q/ha)	Harvest index (%)
I_1	40.05	24.24
I_2	52.81	24.50
I_3	48.26	24.55
I_4	60.37	24.84
C.D. at 5 % level	**11.64**	**NS**
Weed control treatments		
W_1	36.57	23.35
W_2	58.66	24.92
W_3	50.34	24.79
W_4	55.91	24.79
C.D. at 5 % level	**6.80**	**NS**

FIGURE 5 : EFFECT OF IRRIGATION LEVELS ON BIOLOGICAL YIELD (Q/HA)

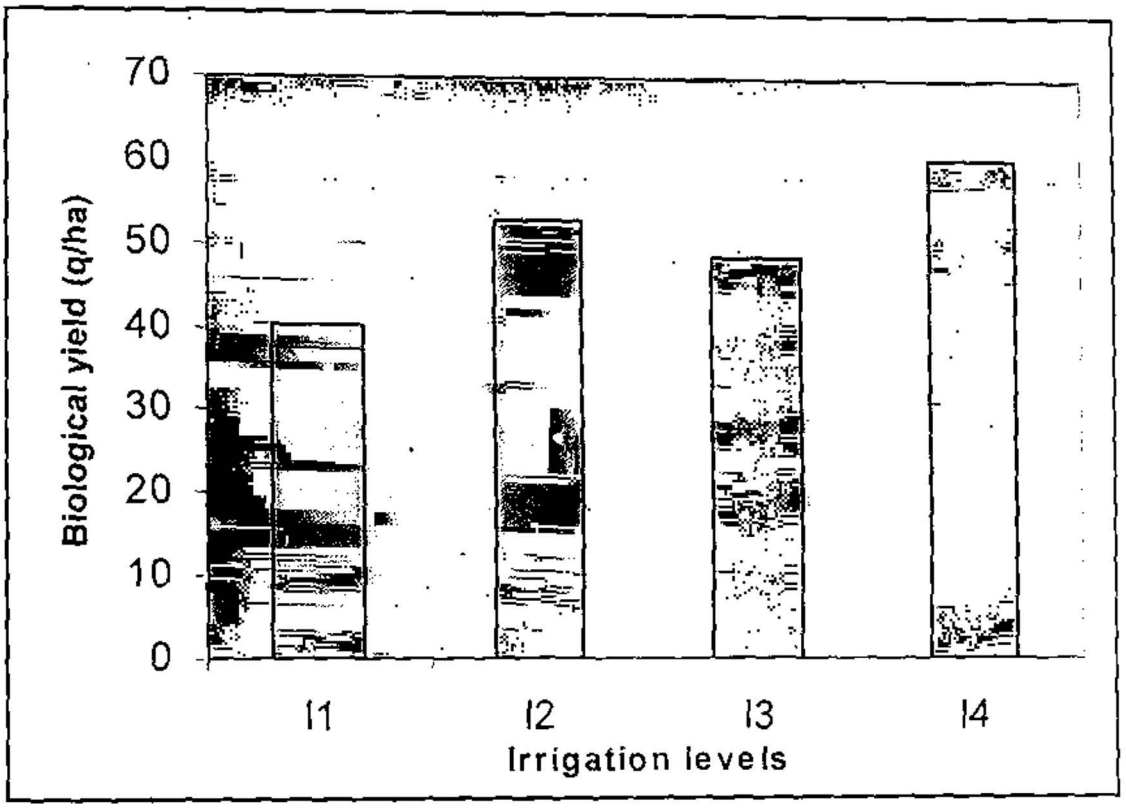
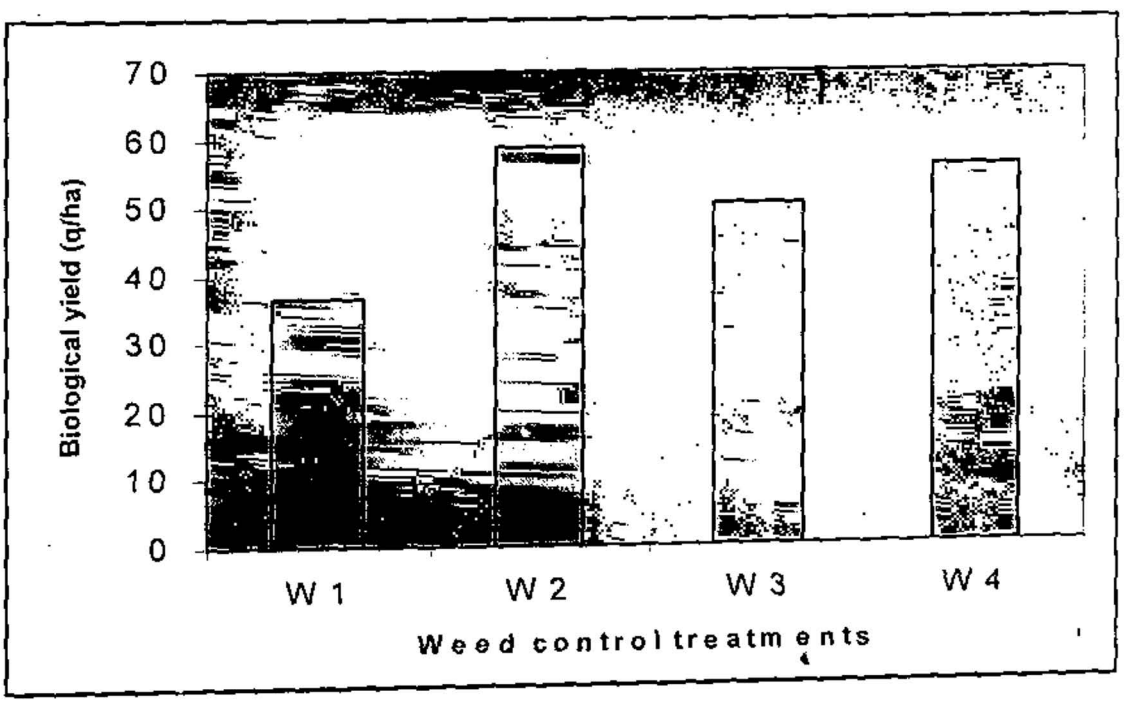


FIGURE 6 : EFFECT OF WEED CONTROL TREATMENTS ON BIOLOGICAL YIELD (Q/HA)



I_3 treatment. The minimum test weight was recorded under I_1 and I_2 irrigation levels which produced the seeds of statistically similar test weight.

Different weed control treatments also influenced the test weight. Weed free treatment produced the maximum (17.31 g) test weight. Pendimethalin 1.5 Kg /ha produced statistically similar test weight as that of weed free. No significant differences were observed between pendimethalin 1.0 Kg /ha (W_3) and pendimethalin 1.5 Kg /ha (W_4) treatment. The minimum test weight (15.69 g) was observed under W_1 i.e. weedy check.

4.3.2 Standard germination percentage

The Table 9 revealed that, all irrigation levels were statistically at par for germination percentage, though the maximum was obtained with I_4 treatment (77.94 %). Weed control treatments also could not influence the germination percentage, although, the highest was obtained under weed free treatment.

4.3.3 Seed vigour index

Table 10 clearly indicate that maximum seed vigour (1126.65) was recorded where the crop received four irrigations at an interval of 30, 60, 90 and 120 DAS (I_4) followed by three irrigations at an interval of 30, 60 and 120 DAS (I_2). The I_2 and I_3 irrigation levels gave statistically similar vigour index. Minimum seed vigour index (930.65) was recorded when the crop was given two irrigationsat an interval of 30 and 90 DAS (I_1).

Application of pendimethalin affected the seed vigour. The maximum seed vigour index (1140.21) was recorded in weed free (W_2) which was

Table 9. **Effect of irrigation levels and Weed control treatments on test weight and standard germination percentage.**

Irrigation levels	Test weight (g)	Germination (%)
I_1	16.18	76.88
I_2	16.45	77.83
I_3	16.75	77.42
I_4	17.16	77.94
C.D. at 5 % level	**0.28**	**NS**
Weed control treatments		
W_1	15.69	77.08
W_2	17.31	78.42
W_3	16.58	77.50
W_4	16.96	77.00
C.D. at 5 % level	**0.79**	**NS**

significantly higher than weedy check (W_1) and the pendimethalin at 1.5 Kg /ha (W_4). No significant differences were found between weed free and pendimethalin at lower dose. Minimum seed vigour (911.37) was obtained under W_4 treatment i.e. pendimethalin 1.5 Kg /ha.

4.4 SOIL MOISTURE STUDIES

4.4.1 Consumptive use of water

Under various irrigation levels tried, the values of consumptive use of water are presented in Table 11. The data indicated that the consumptive use was highest (328.20 mm) under the maximum irrigation levels (I_4) followed by I_2. The consumptive use of water between I_2 and I_3 treatment was almost similar. The minimum consumptive use (238.78 mm) was recorded in I_1 treatment in which only two irrigations were given.

4.4.2 Water use efficiency

The values of water use efficiency calculated under various levels of irrigation are presented in Table 11. The data revealed that the water use efficiency (WUE) increased with the increase in the levels of irrigation. Maximum WUE (4.57 Kg/ha-mm) was recorded under I_4 treatment followed by I_2 and I_3 treatments, respectively. The minimum WUE (4.07 Kg/ha-mm) was obtained under I_1 irrigation levels.

4.5 WEED STUDIES

4.5.1 Total number of weeds, 80 days after sowing (DAS)

Total number of weeds for one square meter area as affected by different levels of irrigation and pendimethalin are presented in Table 12. The

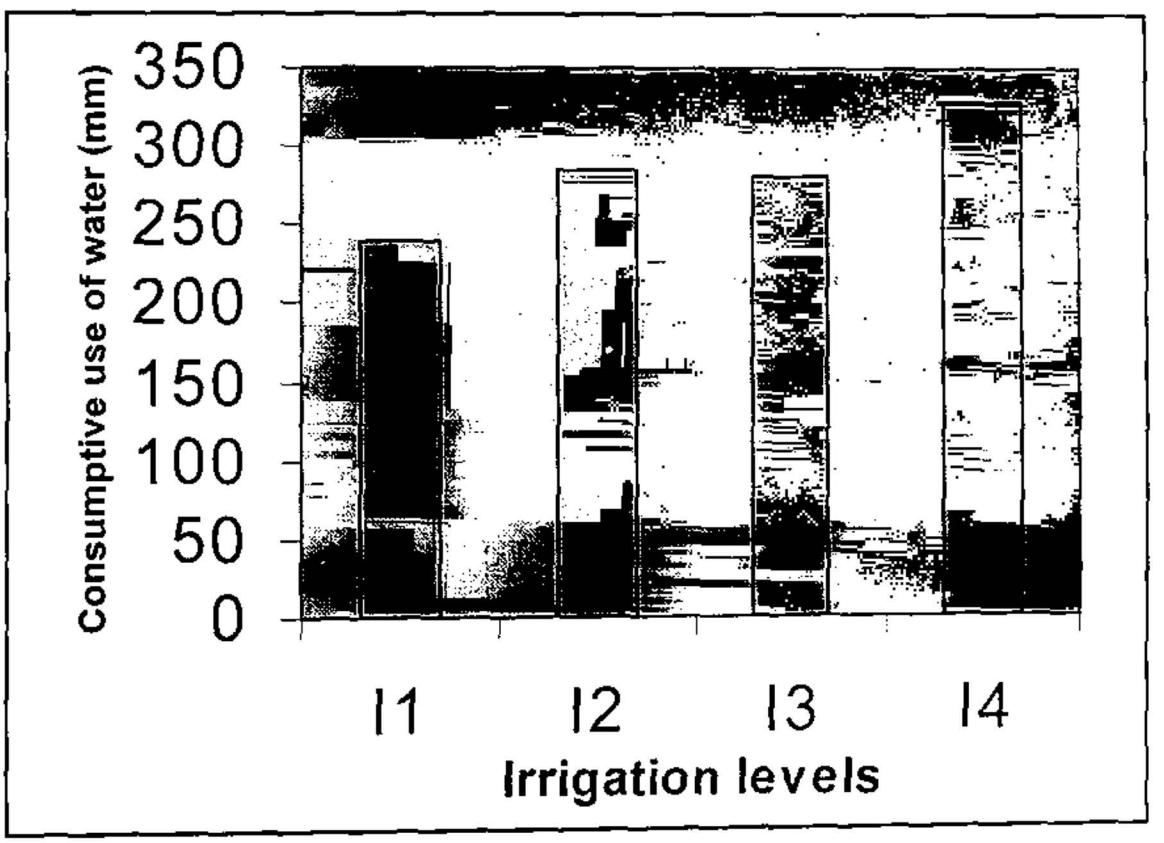
Table 10. **Effect of irrigation levels and Weed control treatments on seed vigour index.**

Irrigation levels	Seed vigour index
I_1	930.65
I_2	1038.48
I_3	997.47
I_4	1126.65
C.D. at 5 % level	**103.18**
Weed control treatments	
W_1	999.32
W_2	1140.21
W_3	1042.35
W_4	911.37
C.D. at 5 % level	**110.19**

Table 11. **Effect of irrigation levels on consumptive use of water and water use efficiency.**

Treatment	Consumptive use (mm)	Water use efficiency (Kg/ha-mm)
Irrigation levels		
I_1	238.78	4.07
I_2	285.73	4.53
I_3	280.00	4.23
I_4	328.20	4.57

FIGURE 7: EFFECT OF IRRIGATION LEVELS ON CONSUMPTIVE USE OF WATER (mm)



data indicate that the maximum number of weeds were recorded in the plots which received four irrigations at 30, 60, 90 and 120 DAS, which was found statistically at par with I_2 and I_3 irrigation levels where three irrigations were given . Minimum weeds (178.23) were found in I_1 where two irrigations were applied.

Application of pendimethalin significantly influenced the number of weeds. The minimum number of weeds (62.82) were recorded under the W_4 treatment in which pendimethalin was applied at 1.5 Kg /ha. Obviously, the highest number of weeds (517.00) were observed under weedy check (W_1) treatment.

A perusal data of interaction between irrigation levels and weed control is presented in Table 13. The data revealed that the maximum number of weeds (562.70) were recorded in weedy check plots which were irrigated four times at an interval of 30, 60, 90 and 120 DAS (I_4). The minimum number of weeds (57.30) were recorded in the plots irrigated as per I_4 treatment and where pendimethalin was applied at 1.5 Kg /ha.

4.5.2 Total number of weeds, 120 DAS

The effect of different levels of irrigation and pendimethalin on total number of weeds for one square meter area are also presented in Table 12. The data revealed that the number of weeds increased significantly with the increase in the levels of irrigation. The I_4 treatment produced the maximum number of weeds (150.63) which was followed by I_2. The minimum (107.23) number of weds were observed under I_1 irrigation level.

Table 12. **Effect of irrigation levels and Weed control treatments on total number of weeds (1sq. m. area) .**

Irrigation levels	Total number of weeds	
	80 DAS	120 DAS
I_1	178.23	107.23
I_2	233.10	140.00
I_3	231.77	134.43
I_4	234.67	150.63
C.D. at 5 % level	**3.84**	**2.16**
Weed control treatments		
W_1	517.00	296.65
W_2	-	-
W_3	78.50	56.82
W_4	62.82	45.75
C.D. at 5 % level	**4.66**	**2.48**

Table 13. **Interactive effects of irrigation levels and Weed control treatments on number of weeds after 80 DAS (1 sq.m. area).**

Treatment	Weed control treatments				
	W_1	W_2	W_3	W_4	Mean
Irrigation levels					
I_1	396.00	-	70.70	68.00	178.23
I_2	560.00	-	75.30	64.00	233.10
I_3	549.30	-	84.00	62.00	231.77
I_4	562.70	-	84.00	57.30	234.67
Mean	517.00	-	78.50	62.82	

CD at 5 % level

i.	Irrigation levels	3.88
ii.	Weed control treatments	4.66
iii.	Irrigation levels x Weed control treatments	9.32

Table 14. **Interactive effects of irrigation levels and Weed control treatments on total number of weeds after 120 DAS (1 sq.m. area).**

Treatment	Weed control treatments				
	W_1	W_2	W_3	W_4	Mean
Irrigation levels					
I_1	226.70	-	54.00	41.00	107.23
I_2	313.30	-	58.00	48.70	140.00
I_3	305.30	-	56.00	42.00	134.43
I_4	341.30	-	59.30	51.30	150.63
Mean	296.65	-	56.82	45.75	

CD at 5 % level

i.	Irrigation levels	2.16
ii.	Weed control treatments	2.48
iii.	Irrigation levels x Weed control treatments	4.96

Different weed control treatments also influenced the number of weeds. The minimum number of weeds (45.75 in one square meter area) were recorded in the plots which were treated with pendimethalin at 1.5 Kg/ha which was closely followed by pendimethalin at 1.0 Kg /ha produced 56.82 weeds in one sq.m. area. As was evident the highest number of weeds (296.65 in one sq. m. area) were produced by weedy check plots.

A data of interaction presented in Table 14 revealed that the maximum number of weeds (341.30) were observed under the weedy check plots (W_1) which received four irrigations at 30, 60, 90 and 120 DAS (I_4). Minimum number of weeds (41.00) were obtained in plots where there was application of pendimethalin at 1.5 Kg/ha and were applied two irrigations at an interval of 30 and 90 DAS.

4.5.3 Dry weight of weeds, 80 DAS

The data pertains to the effect of irrigation levels and weed control treatments on dry weight of weeds at 80 DAS are presented in Table 15. The data revealed that the dry weight was increased with the increase in the irrigation frequency. The maximum dry weight (17.27 q/ha) was recorded under I_4 treatment which was significantly higher to I_1 and I_3 treatment but statistically at par with I_2 treatment. However, minimum dry weight (12.53 q/ha) was recorded under I_1 treatment.

Weed control treatments also influenced the dry weight of weeds. Maximum dry weight (39.53 q/ha) was recorded under weedy check plots

Table 15. **Effect of irrigation levels and Weed control treatments on dry weight of weeds (q/ha).**

Irrigation levels	Dry weight of weeds (q/ha)	
	80 DAS	120 DAS
I_1	12.53	15.36
I_2	16.24	20.80
I_3	15.64	22.53
I_4	17.27	25.05
C.D. at 5 % level	**1.46**	**0.89**
Weed control treatments		
W_1	39.53	52.30
W_2	-	-
W_3	4.27	6.94
W_4	2.45	3.57
C.D. at 5 % level	**1.72**	**1.54**

(W_1). Application of pendimethalin at 1.5 Kg/ha gave the minimum dry weight of weeds (2.45 q/ha) which was significantly lesser than the plots in which pendimethalin was applied at 1.0 Kg /ha (W_3) and weedy check plots (W_1).

4.5.4 Dry weight of weeds, 120 DAS

As the irrigation frequency increased the dry weight of weeds also increased (Table 15). Maximum dry weight (25.05 q/ha) was obtained in the plots where maximum number of irrigations were applied (I_4) which was statistically higher to rest of the irrigations treatments. However, minimum dry weight (15.36 q/ha) of weeds was recorded where only two irrigations were given (I_1). If we compare the I_2 and I_3 treatments which received equal number of irrigations (3), though at different intervals, I_3 produced more dry weight compared to I_2.

Evidently pendimethalin at 1.5 Kg /ha produced the minimum dry weight (3.57 q/ha) of weeds which was found to be most effective and was followed by pendimethalin at 1.0 Kg/ha. Weedy check produced the maximum dry weight (52.30 q/ha) of weeds.

The interaction data (Table 16) between the effect of irrigation levels and weed control treatments on dry weight of weeds after 120 days after sowing revealed that the maximum dry weight of weeds (60.80 q/ha) recorded under weedy check plots (W_1) supplied with irrigation water at 30, 60, 90 and 120 DAS (I_4). The minimum dry weight (2.72 q/ha) was recorded under W_4 treatment where pendimethalin was applied at 1.5 Kg /ha and was given irrigation water at 30 and 90 DAS (I_1).

Table 16. **Interactive effects of irrigation levels and Weed control treatments on dry weight of weeds taken after 120 DAS (q/ha).**

Treatment	Weed control treatments				
	W_1	W_2	W_3	W_4	Mean
Irrigation levels					
I_1	39.08	-	4.28	2.72	15.36
I_2	53.32	-	6.00	3.08	20.80
I_3	56.00	-	8.00	3.60	22.53
I_4	60.80	-	9.48	4.88	25.05
Mean	52.30	-	6.94	3.57	

CD at 5 % level

i.	Irrigation levels	0.88
ii.	Weed control treatments	1.54
iii.	Irrigation levels x Weed control treatments	3.08

4.6 ECONOMICS

The data on total cost of cultivation, gross returns and net returns are presented in Table 17. The treatment wise cost of cultivation varied from Rs. 17640 to 26200 per hectare. The net return data showed that the highest returns (21406.25) were obtained under I_4 treatment i.e. when irrigation was applied four times at 30, 60, 90 and 120 DAS. It was followed by I_2 treatments i.e. three irrigations at 30, 60 and 120 DAS. The minimum returns were obtained when only two irrigations were applied (I_1) at 30 and 90 DAS.

Regarding weed control treatments maximum returns (Rs. 19695 per hectare) were obtained at pendimethalin 1.5 Kg/ha which was closely followed by weed free treatment (W_2). Of course, minimum returns were given by weedy check (Rs. 6075 per hectare).

If we see the interactive effects of irrigations and weed control treatments in Table 18, the highest net return per hectare i.e. Rs. 26140 were obtained, when crop was irrigated four times i.e. at 30, 60, 90 and 120 DAS (I_4) and at 1.5 Kg/ha application of pendimethalin. It was closely followed by I_4 and W_2 interaction. The minimum returns were given by I_1 and W_1 interaction i.e. when crop was irrigated two times at 30 and 90 days after sowing and weed were not removed during the entire growing season.

Table 17. **Economics of the treatments in coriander seed crop as influenced by different irrigation levels and weed control treatments.**

Treatment	Cost of cultivation (Rs. ha^{-1})	Gross returns ((Rs. ha^{-1}))	Net return (Rs. ha^{-1})
I_1W_1	17640	22410	4770
I_1W_2	22440	35580	13140
I_1W_3	19205	27720	8515
I_1W_4	19990	30780	10790
I_2W_1	19520	24630	5040
I_2W_2	24320	45990	21670
I_2W_3	21085	40080	18995
I_2W_4	21870	44550	22680
I_3W_1	19520	23070	3550
I_3W_2	24320	42180	17860
I_3W_3	21085	35850	14765
I_3W_4	21870	41040	19170
I_4W_1	21400	32340	10940
I_4W_2	26200	51690	25490
I_4W_3	22965	46020	23055
I_4W_4	23750	49890	26140

Table 18. Economics of the treatments (Net Returns Rs.ha^{-1})

Treatments	W_1	W_2	W_3	W_4	Total	Mean
I_1	4770	13140	8575	10790	37215	9303.75
I_2	5040	21670	18995	22680	68385	17096.25
I_3	3550	17860	14765	19170	55345	13836.25
I_4	10940	25490	23055	26140	85625	21406.25
Total	24300	78160	65330	78780		
Mean	6075	19540	16332.5	19695		

CHAPTER –5

DISCUSSION

The yield is the result of interaction between genetic potential and the environmental conditions to which the plant is exposed during its life cycle. The yield potential of a genotype may be exploited only under the most optimum environmental conditions. Though, it is not possible to control precisely, the environment under field conditions, yet favourable environment can be provided by judicious organisation of manageable factors like water management, plant density, sowing of crop at optimum time, nutrient and weed control which to a considerable extent may help to harness the genetic potential of a cultivar.

The present investigations were therefore, carried out to study the "Effect of irrigation and pendimethalin on weed control and seed yield of coriander". The results presented in the previous chapter are discussed here.

5.1 EFFECT OF IRRIGATION

Plant height, number of primary branches per plant and number of umbels per plant increased significantly with the increase in irrigation intensity. All these growth characters were observed maximum with the application of four irrigations in I_4 treatment at 30, 60, 90 and 120 DAS (Table 4 and 5). The pronounced effect of irrigation on growth characters

might be attributed due to beneficial effect of water on cell turgidity, cell elongation, photosynthesis, respiration, uptake of nutrients and translocation of photosynthates to the actively growing plant parts. These observations are also supported by the results of Tomar *et al.* (1994), Ali *et al.* (1994), Lal *et al.* (1996) in coriander. Days taken to 50 per cent flowering were less in drier regimes with the minimum in I_1 treatment where only two irrigations were applied, whereas in I_4 treatment where four irrigations were given took more number of days to 50 per cent flowering (Table 5). This may be due to the reason that water deficit forced the plant to enter into reproductive phase earlier than that of wetter regimes. These results are in agreement with the findings of Yadav *et al.* (1998) in fennel. However, the results are contradictory to the findings of Batra (1985) who reported that irrigation had no significant effect on days to 50 per cent flowering in carrot. Biological yield and seed yield per hectare and per plant were also influenced by the different irrigation treatments. These parameter were better under I_4 treatment where four irrigations were given during the entire growing season. The favourable effect of irrigation may be explained on the basis of more plant height (Table 4) which ultimately leads to more number of branches and hence more number of umbels per plant. Significant increase in seed and biological yield at higher irrigation levels corroborates the findings of Lal *et al.* (1996), Tomar *et al.* (1994), Horlok and Csaki (1987) in coriander. Desai *et al.* (1989) in fennel and fenugreek, Singh and Thakral (1995) in fenugreek.

Contrary to these findings Desai *et al.*(1989) in Gujarat obtained the higher yield of cumin with the lesser number of irrigations. The harvest index was not influenced by any of the irrigation treatments. The reason being both the seed as well as biological yield increased simultaneously as the irrigation intensity increased. However, in fennel, Yadav *et al.* (1998) had contradictory report that harvest index increased with increase in irrigation intensity. Seed quality is determined by its boldness expressed in terms of test weight. Test weight of seed was found maximum when the crop was irrigated four times at 30, 60, 90 and 120 DAS (I_4). Similar results were also reported by Lal *et al.* (1998) in coriander and Yadav *et al.* (1998) in fennel, who reported higher test weight with frequent irrigation. However, standard germination percentage was not affected by any of the irrigation levels. Yadav *et al.* (1998) in fennel and Batra (1985) in carrot also reported the similar findings. Seed vigour index was increased with the increase in irrigation levels. These findings are supported by Batra (1985) while working on carrot.

Consumptive use of water (CUW) by coriander increased with the increase in irrigation frequency and it was found maximum under I_4 treatment where four irrigations were given at 30, 60, 90 and 120 DAS. This may be due to the fact that soil layer remained wet for the longer duration under frequent irrigation treatments, which resulted for higher rate of evaporation as compare to three irrigations in I_2 and I_3 treatment and two irrigations in I_1 treatment. High rate of water absorption by roots in frequently irrigated plots

maintained higher leaf water potential, better stomatal conductance and there by high transpiration. These might also be due to better vigour and large exposure of plant canopy which resulted in utilization of available soil moisture more efficiently and finally increased the CUW. In general, water use efficiency (WUE) was higher with the increase in irrigation intensity and was found maximum under I_4 treatment and the minimum under I_1 treatment where only two irrigations were given. Among the I_2 and I_3 treatments where three irrigations were given at 30, 60 and 120 DAS in I_2 and 30, 90 and 120 DAS in I_3, the WUE was reported higher in I_2 treatment. The reason for higher WUE in I_4 followed by I_2 may be due to the fact that under these treatments seed yield was reported higher but the consumptive use in I_2 and I_3 was almost similar. These results are in conformity with the finding of Lal *et al.* (1996) in coriander, Yadav *et al.* (1998) in fennel and Patel *et al.* (1992) in cumin. Each successive increase in irrigation, there was significant increase in weed density and dry matter of weeds. Similar observation have also been reported by Singh and Bhan (1998) while working on wheat at Jabalpur.

5.2 EFFECT OF PENDIMETHALIN

The yield of the crop was maximum in weed free treatment because there was no competition between weeds and crop in this treatment during the entire growing season. Hence, plant height, number of umbels per plant were found maximum and leaves accumulated maximum dry matter, thus leaf area may have increased which resulted in higher interception of irradiance, thus

increased the availability of assimillates for the growth and development of the crop as well as seed. Since competition between crop and weeds was maximum in weedy check, which resulted in lowest accumulation of dry matter by leaves, thus the growth and yield of the crop was recorded lowest in this treatment. These results are in accordance with the results obtained by previous workers/Thakral *et al.* 1989 in coriander; Baljeet Bhyan, 1983; Hira, 1980 and Bhutani *et al.*. 1979 in cauliflower; Khurana and Melaren, 1982 in potato).

Pendimethalin at 1.0 and 1.5 Kg /ha gave good control of weeds, thus increased the availability of light, nutrients, moisture and space to the crop. Due to this plant height, number of primary branches, number of umbels per plant increased and dry matter accumulation by leaves also increased, which resulted in higher seed yield in these treatments by increasing the assimillates available for the growth and development of the seed. Pendimethalin has been found effective in controlling weeds and increasing the yield of various vegetable crops such as coriander (Mitchell *et al.*, 1994; Thakral *et al.*, 1989), fennel (Rapparini and Campagna, 1996), fennugreek (Mali and Suwalka, 1987) and cumin (Parihar and Jangir, 1987). Regarding quality studies like test weight and seed vigour, pendimethalin @ 1.0 Kg /ha was found effective in improving the test weight and seed vigour. These results are in conformity with the findings of Singh (1979) in okra seed crop, who reported that various herbicides were found to increase the seed quality over control i.e. weedy

check. However, on the other hand, pendimethalin at 1.5 Kg /ha was found in reducing the germination percentage and seed vigour index. This may be due to the reason that pendimethalin at higher concentrations had adverse effect on seed vigour. The standard germination percentage could not influenced by the two pendimethalin doses.

5.3 ECONOMICS OF THE TREATMENTS

I_4 irrigation levels gave the highest return of Rs. 21406.25 per hectare as compared to other irrigation levels. However, amongst the different weed control treatments pendimethalin at 1.5 Kg/ha gave the highest return of RS. 19695 per hectare. I_4W_4 (irrigation at 30, 60, 90 & 120 DAS and pendimethalin at 1.5 Kg/ha) combination gave the highest returns per hectare i.e. Rs. 26140 per hectare. Ahlawat *et al.* (1981) and Amarjeet (1998) also obtained higher net returns with chemical weed control in pea.

CHAPTER –6

SUMMARY AND CONCLUSION

6.1 EFFECT OF IRRIGATION

The experiment was carried out at the Research Farm and Laboratory of the Department of Vegetable Crops, CCS Haryana Agricultural University, Hisar during the year 1999-2000 with a view to study the "Effect of irrigation and pendimethalin on the weed control and seed yield of coriander".

The experiment was laid out in split plot design with three replications having four moisture regimes (I_1 - irrigation at 30 and 90 days after sowing (DAS), I_2 - irrigation at 30, 60 and 120 DAS, I_3 - irrigation at 30, 90 and 120 DAS, I_4 - irrigation at 30, 60, 90 and 120 DAS,) as main plot treatments and four weed control treatments (W_1 – Weedy check, W_2 – Weed free, W_3 – Pendimethalin at 1.0 Kg /ha and W_4 – Pendimethalin at 1.5 Kg/ha) in sub plots. Genetically, pure seed was sown on 9th November, 1999. The observations were recorded on growth, flowering, seed yield and quality. The summary of the results is given below:

1. Coriander seed crop responded well to the irrigations at I_4 treatment i.e. four irrigations at 30, 60, 90 and 120 DAS, resulting in to improvement in all the growth characters like plant height, number of primary branches and number of umbels per plant.

2. The number of days taken for flowering increased with increase in number of irrigations. The crop when irrigated four times at 30, 60, 90 and 120 DAS took maximum number of days to 50 per cent flowering. The minimum days for 50 per cent flowering were taken when two irrigations were given at 30 and 90 DAS.

3. Higher biological yield was observed when the crop was given four irrigations. However, I_2 treatment produced statistically similar biological yield as that of I_4, the minimum was produced by I_1 treatment.

4. Seed yield (q/ha) also increased significantly with the increase in irrigation levels. A significant higher seed yield was obtained with the application of four irrigations at an interval of 30, 60, 90 and 120 DAS, which was statistically at par with I_2 treatment irrigated at 30, 60 and 120 DAS. The minimum seed yield was obtained under I_1 irrigation level.

5. Irrigation levels did not influence the harvest index.

6. Maximum test weight was found under I_4 irrigation treatment which received maximum number of four irrigations at 30, 60, 90 and 120 DAS, which was followed by I_3 irrigations treatment. The minimum test weight was found under I_1 and I_2 which produced statistically similar test weight.

7. Germination percentage was not affected by various irrigation levels.

8. The maximum seed vigour was recorded when the crop received four irrigations at an interval of 30, 60, 90 and 120 DAS, followed by three

irrigations at an interval of 30, 60 and 120 DAS. The minimum seed vigour was recorded under I_1 irrigation level.

9. Consumptive use of water was found maximum under the wettest regime (I_4), followed by I_2. The minimum consumptive use was recorded in I_1 treatment which received only two irrigations.

10. Like consumptive use, water use efficiency also recorded maximum under I_4 treatment followed by I_2 and I_3 treatments, respectively. The minimum water use efficiency was obtained under I_1 irrigation levels.

11. Maximum number of weeds at 80 and 120 DAS produced by I_4 treatment. I_1 produced the minimum.

12. Maximum dry weight of weeds at 80 and 120 DAS was obtained in the plots where four irrigations at 30, 60, 90 and 120 DAS were applied. However, minimum dry weight was recorded under I_1 where only two irrigations at 30 and 90 DAS were given.

13. More returns were obtained at I_4 irrigation levels and the minimum returns were obtained under I_1 treatment.

6.2 EFFECT OF WEED CONTROL

1. Maximum plant height was recorded in the weed free treatment which was at par with pendimethalin at 1.5 Kg /ha. The minimum height was observed in weedy check.

2. The weed free treatment produced maximum number of primary branches per plant followed by pendimethalin at 1.5 Kg /ha. The minimum branches per plant were observed in weedy check.

3. Highest number of umbels per plant were produced by weed free treatment. Pendimethalin at 1.5 Kg/ha also gave the similar number of umbels per plant as were produced by weed free treatment. Weedy check produced the minimum number of umbels per plant.

4. Weedy check took more days to flowering over other weed control treatments. Weed free treatment took minimum days to flowering.

5. Weed free treatment produced the maximum seed yield per plant and per hectare. No differences between pendimethalin 1.0 Kg/ha and pendimethalin 1.5 Kg/ha were observed. The minimum seed yield was recorded under weedy check (W_1).

6. Weed free and pendimethalin 1.5 Kg/ha gave statistically similar and maximum biological yield. The minimum biological yield was obtained in weedy check (W_1).

7. Various weed control treatments did not influence the harvest index.

8. Maximum test weight was recorded with weed free treatment (W_2) which was at par with pendimethalin 1.5 Kg/ha. The minimum test weight was observed under weedy check.

9. Highest seed vigour index was obtained under weed free, the lowest was obtained under W_4 i.e. pendimethalin 1.5 Kg/ha.

10. The standard germination percentage was not influenced by any of the weed control treatments.

11. The minimum weeds at 80 and 120 DAS were recorded in the plots which were treated with pendimethalin at 1.5 Kg/ha (W_4) and the maximum by weedy check.

12. The dry weight of weeds at 80 and 120 DAS was obtained maximum under weedy check while pendimethalin 1.5 Kg/ha gave the minimum dry weight of weeds.

13. Maximum returns were obtained at pendimethalin at 1.5 Kg/ha as pre emergence and the minimum were obtained under weedy check.

6.3 INTERACTION EFFECT

Significant differences were observed in relation to interaction between irrigation and weed control treatments for days to 50 per cent flowering, number of weeds at 80 and 120 DAS and dry weight of weeds at 120 DAS.

CONCLUSION

From the present studies it is concluded that for raising a successful seed crop of coriander in Haryana, four irrigations at 30, 60, 90 and 120 DAS should be applied. Regarding weed control treatments, weed free gave the highest seed yield and quality. Pendimethalin at 1.0 Kg/ha was found superior over 1.5 Kg/ha for seed quality. However, seed yield was found at par with both the pendimethalin doses. Hence four irrigations at 30, 60, 90 and 120 days after sowing and pendimethalin at 1.0 Kg/ha (Stomp 3.33L/ha) as pre emergence is recommended.

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