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Relationship between Meteorological Elements and Yield of Perilla in Yeosu Area

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ABSTRACT

This study was conducted to investigate the relationship between yearly variations of climatic elements and yearly variations of productivity in perilla. In addition, correlation coefficients among yield and yield components were estimated. The data of yield and yield components were investigated for 10 years from 1991 to 2000.

The meteorological data gathered at the Yeosu Weather Station for the same period were used to find out the relationships between climatic elements and productivity. Yearly variation of the amount of precipitation in September was large with coefficients of variation(c. v.) of 11.1%, but the coefficient of variance(c. v.) in July and August were relative small with 1.8, 2.1%, respectively.

Number of cluster per hill and weight of 1,000 grains were greatly with c. v. of 76.1, 79.3%, respectively, but the coefficients of variance(c. v.) of plant height and seed yield were more less with 9.58, 10.60%, respectively.

Correlation coefficients between precipitation of September and seed yield were positively significant correlation at the level of 5.1%, respectively, but the duration of sunshine in September and seed yield were negatively significant at the level of 5.1%, respectively.

Correlation coefficients of these, the plant height, number of branches per plant, cluster length, number of cluster per hill, weight of 1,000 grains and seed yield were positively significant at the level of 5.1% respectively.

Key words : Climatic elements, productivity of perilla

INTRODUCTION

Crop has a close relation to the environmental effects, especially weather condition. Many scholars reported(Kwon, 1993; Kwon *et al.*, 1986; Kwon *et al.*, 1994; Cho *et al.*, Cho and Chung 1979; Choi *et al.*, 1979; Kim *et al.*, 1993; Hyun, 1982; Lee *et al.*, 1977; Li, 1982; Robert, 1982; Ryu *et al.*, 1977; Rhu *et al.*, 1982; Park, 1975; Won *et al.*, 1983) the results of research on weather and growth of crops and recently the research of meteorological effect evaluation and yield predicition has been develpoed.

This experiment develops the estimated equation of perilla yield with a lot demands and analysis the relation

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of weather conditions to perilla growth and yield at Yeosu area, Jeonnam in order to obtain the basic data of relation of crop to weather conditions and to develop safe cultivation and production techniques according to changes of meteorological environments and then the following results are reported.

We wish to show our thanks to related agencies and farm house which cooperated to carry out this research.

MATERIALS AND METHOD

This experiment uses the yield produced from 1991

Table 1. Cultivation area and yield of perilla in Yeosu area

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Cultivation area (ha)	34.0	44.3	71.6	74.2	43.0	23.8	26.8	34.8	32.0	25.7
Yield (kg/10a)	84	76	61	58	72	65	84	80	83	83

Table 2. Variabilities of meteorological factors for 10 experimental years (1991-2000)

Meteorological	Month	Max.	Min.	Mean±SD	Range	C.V.(%)
Air temperature(℃) Mean	Jun.	22.0	20.2	21.1±1.53	1.8	7.3
	Jul.	27.8	22.4	13.9±1.24	5.4	8.9
	Aug.	27.6	23.4	25.5±1.68	4.2	6.6
	Sep.	23.7	21.3	22.5±1.58	2.4	7.0
	Oct	19.1	16.6	17.9±1.45	2.5	7.9
Max.	Jun.	25.8	22.6	24.2±1.64	3.2	6.8
	Jul.	32.0	25.1	28.6±1.78	6.9	6.2
	Aug.	30.8	26.4	28.6±1.78	4.4	6.2
	Sep.	27.8	24.3	26.1±1.70	3.5	6.5
	Oct	22.4	20.4	21.4±1.54	2.0	7.2
Min.	Jun.	18.9	16.8	17.9±1.41	2.1	7.9
	Jul.	24.9	20.2	22.6±1.58	4.7	7.0
	Aug.	25.0	20.7	22.9±1.60	4.3	6.9
	Sep.	21.3	18.3	19.8±1.48	3.0	7.5
	Oct	16.2	14.0	15.1±1.29	2.2	8.5
Percipitation(mm)	Jun.	381.9	21.9	206.9±4.80	350.0	2.3
	Jul.	546.6	112.5	329.6±6.05	434.1	1.8
	Aug.	603.0	129.9	244.3±5.21	473.1	2.1
	Sep.	246.2	21.9	134.1±14.9	224.3	11.1
	Oct	201.0	18.8	110.0±3.50	182.2	3.2
Duration of sunshine	Jun.	233.9	107.8	170.9±4.36	126.1	2.6
	Jul.	296.5	120.4	208.5±4.81	176.1	2.3
	Aug.	271.6	131.9	201.8±4.74	139.7	2.4
	Sep.	270.3	177.8	224.1±4.99	92.5	3.6
	Oct	271.9	164.3	218.1±4.92	107.6	2.3

to 2000 and meteorological data observed during the cultivation period as shown in Table 1, and induces the estimated equations of correlation among growth, yield and weather conditions, dispersions and yield.

RESULTS AND DISCUSSION

Variabilities of Meteorological Elements

The weather conditions from 1991 to 2000 perilla growth, variability of yield character and the variabilities of meteorological elements during perilla growth period are shown in Table 2.

The greatest variabilities of meteorological elements are precipitation of October their variability coefficients reach 11.1%, the greatest temperature change during cultivation period was occurred in October and variabilities coefficients was minimum temperature 8.5% to the contrary of August, the mean temperature of August was 6.6%, maximum temperature of August, was 6.2%, the minimum temperature of August was 6.9% and it has relatively stable meteorological elements. Considering the variabilities of yield character during the cultivation period in Table 3, while the variability coefficient of plant height was very low as 9.58% and it was governed by genetic characters peculiar to variety, those of number of cluster per hill and number of 1,000 grains were high as 76.1%, 79.3%, respectively, and it is influenced by environmental factors in some degree and such a trend was shown as 28.50% in fresh weight of stem of rush(Kwon, 1993), 30.20% in soybean(Won *et al.*, 1983) and 14.24% in barley(Kim *et al.*, 1993) but in case of mat rush the fiber yield was 6.3%(Kwon *et al.*, 1993) and it is considered that these results were due to the differences in character of crpos.

Correlation among Meteorological Elements, Perilla Growth and Yield

As shown in Table 4. There are negative correlation between temperature of July, August, September and October in mean, maximum and minimum and yield, positive correlations between temperature of June in mean, maximum and minimum air temperature and yield and then it is found that high temperature condition in June, and low temperature condition in July, August, September and October has a favorable influence on the yield.

In the precipitation, there is highly significant positive correlations between the precipitation of September and yield, negative correlations between precipitation of the other month, June, July, August and October and yield and then it is found that small precipitation condition in September has a favorable influence on the yield.

In the duration of sunshine, a negative correlation between the duration of all growth periods, June, July, August, September and October and yield is shown and there are highly significant negative correlation between duration of sunshine of July, Auguest, September and yield, then it is found that small duration of sunshine for

Table 3. Variabilities of agronomic characters for 10 experimental years

Characters	Max.	Min.	Mean	Range	C.V.(%)	±S.D
Plant height (m)	210	147	191	63	9.58	18.33
No. of branches / plant	19	10	15	9	19.26	2.89
Cluster length (cm)	12	7	10	5	48.6	4.86
No. of cluster / hill	62	28	52	34	76.1	39.57
Wt. of 1,000 grans (g)	5.7	2.5	4.6	3.2	79.3	3.65
Seed yield (kg/10a)	84	58	75	26	10.60	7.94

Table 4. Correlation coefficients between agronomic characters and meteorological factors in each month

Meteorological factors	Month	Plant heigth (cm)	No. of branches / plant	Cluster length (cm)	No. of cluster / hill	Wt. of 1,000 grains (g)	Seed yield (kg/10a)
Air temperature (℃)Mean	Jun.	0.373*	0.542**	0.594**	0.314	0.353*	0.422*
	Jul.	-0.515**	-0.245	-0.394*	-0.302	-0.248	-0.229
	Aug.	-0.414*	-0.303	-0.554**	-0.214	-0.208	-0.194
	Sep.	-0.083	0.014	-0.014	0.000	0.042	0.008
	Oct.	-0.054	-0.007	-0.172	0.106	0.097	0.079
Max.	Jun.	0.156	0.332	0.315	0.167	0.198	0.262
	Jul.	-0.576**	-0.308	-0.443*	-0.388*	-0.335	-0.315
	Aug.	-0.428*	-0.346	-0.603**	-0.265	-0.271	-0.253
	Sep.	-0.393*	-0.203	-0.294	-0.290	-0.245	-0.253
	Oct.	-0.304	-0.212	-0.444*	-0.184	-0.204	-0.189
Min.	Jun.	0.433*	0.544**	0.628**	0.321	0.359*	0.409
	Jul.	-0.428*	-0.134	-0.292	-0.189	-0.137	-0.115
	Aug.	-0.339	-0.196	-0.450**	-0.118	-0.107	-0.090
	Sep.	0.275	0.348	0.357*	0.336	0.374*	0.342
	Oct.	0.096	0.117	0.005	0.241	0.238	0.210
Precipitation (mm)	Jun.	-0.487**	-0.411*	-0.417*	-0.345	-0.347	-0.346
	Jul.	-0.486**	-0.513**	-0.486**	-0.546**	-0.531**	-0.554**
	Aug.	-0.064	-0.112	0.205	-0.198	-0.188	-0.194
	Sep.	0.592**	0.594**	0.606**	0.699**	0.712**	0.671**
	Oct.	-0.212	-0.125	-0.118	-0.089	-0.074	-0.068
Duration of sunshine (hr)	Jun.	-0.044	-0.005	-0.088	-0.122	-0.085	-0.104
	Jul.	-0.763**	-0.588**	-0.682**	-0.619**	-0.574**	-0.568**
	Aug.	-0.492**	-0.388	-0.626**	-0.371	-0.379	-0.350
	Sep.	-0.770**	-0.566**	-0.627**	-0.708**	-0.667**	-0.643**
	Oct.	-0.122	-0.096	-0.097	-0.221	-0.239	-0.213

the all growth periods of June, July, August, September and October have a profitable influence on the yield.

Correlation between Growth and Yield and Yield Characters

As shown in Table 5, in correlation between growth and yield characters, a highly significant positive correlation among plant height, number of branches per plant, cluster length, number of cluster per hill, weight of 1,000 grains and yield is shown and the more yield is, the more perilla yield is.

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Table 5. Correlation coefficients between yield components and yield

Characters	2)	3)	4)	5)	6)
1) Plant heigth (cm)	0.923**	0.895**	0.958**	0.948**	0.940**
2) No. of branches / plant		0.945**	0.938**	0.957**	0.971**
3) Cluster length (cm)			0.849**	0.872**	0.883**
4) No. of cluster / hill				0.995**	0.989**
5) Wt. of 1,000 grains (g)					0.996**
6) Seed yield (kg/10a)					-

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