Effect of Meteorological Elements on Yield of Malting Barley 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 malting barley. 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 varation of the amount of precipitation in December and January were large with coefficients of variation(c. v.) of 97.9, 51.3%, respectively, but the variation of the maximum temperature and minimum temperature in April were relative small. Yield, weight of 1,000 grains and culm length were greatly with c. v. of 37.3, 49.3 and 41.3%, respectively. spike length and number of spikes show more or less c. v. of 3.8, 24.7% respectively and number of grains per spike show still less variation with c. v. of 9.4%. Correlation coefficients between temperature of mean, maximum and minimum in February and seed yield and yield components were positively significant at level of 5.1%, respectively. Correlation coefficients between precipitation of April and seed yield were positively significant correlation at the level of 5.1%, respectively, but the duration of sunshine in April and seed yield were negatively significant at the level of 5.1%, respectively. Correlation coefficients of those, yield components and yield, culm length, spike length, number of grains per spike, number of spikes per m², weight of 1,000 grains and seed yield were positively significant at the level of 5.1% respectively.

Key words **:** climatic elements, productivity of malting barley

INTRODUCTION

Crop has a close relation the environmental effects, especially weather condition. Many scholars reported(Kwon, 1993; Kwon *et al.*, 1986: Kwon *et al.*,1982; Cho and Chung 1979; Choi *et al.*, 1993; Hyun, 1982; Lee *et al.*, 1977; Li, 1982; Robert, 1982; Ryu *et al.*, 1977; Rhu *et al.*, 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 malting barley yield with a lot demands and analysis the

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relation of weather. conditions to malting barley 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 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.

RESULT AND DISCUSSION

Variabilities of Meteorological Elements

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

The greatest variabilities of meteorological elements are precipitation of December and January with c. v. of 97.9, 53.1%, respectively, but the variation of the temperature of mean, maximum and minimum in April were relative small with c. v. of 5.7, 5.0, 6.2%, respectively.

Considering the variabilities of yield character during the cultivation period in Table 3, while the variability coefficient of number of grains per spike was very low as 9.4% and it is governed by genetic characters to variety, those of the culm length, weight of 1,000 grains and seed yield were high as 41.3, 49.3, 37.3%, 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, Malting Barley Growth and Yield.

As shown in Table 4. There are positive correlation between temperature of October, November, December, January, February, March, April and May in mean, maximum and minimum and yield, and then it is found that high temperature condition in October, November, December, January, February, March, April and May has a favorable influence on the yield.

In the precipitation, there is highly significant negative correlations between the precipitation of October, November and April and yield, negative correlations between precipitation of the other month, December, January, February, March and May and yield and then it is found that small precipitation condition in September and October have a favorable influence on the yield.

In the duration of sunshine, a negative correlation between the duration of all growth periods, October,

Table 1. Cultivated area and yield of malting barley in Yeosu area

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Cultivation area(ha)	2,473.0	2,688.0	2,242.0	2,126.0	1,464.0	1,224.0	1,090.0	955.5	979.0	979.1
Yield (kg/10a)	302.0	309.0	306.3	302.3	315.0	313.0	370.0	377.0	238.0	296.0

Table 2. Variabilities of meteorological elements for 10 experimental years(1991-200)

Metearological elements	Month	Max.	Min.	Mean	±S.D	Range	C.V.(%)
Air temperature (℃)Mean	Oct.	19.1	16.6	17.9	1.45	2.5	7.9
	Nov.	13.1	9.8	11.2	0.76	3.3	6.8
	Dec.	6.9	3.8	5.4	0.56	3.1	10.4
	Jan.	4.2	2.1	3.2	0.54	2.1	16.8
	Feb.	6.4	2.3	4.4	0.36	4.1	8.2
	Mar.	9.2	6.3	7.8	0.69	2.9	8.8
	Apr.	15.0	11.3	13.2	0.75	3.7	5.7
	May	18.8	16.6	17.7	4.43	2.2	25.0
Air temperature (℃)Max.	Oct.	22.4	20.4	21.4	1.54	2.0	7.2
	Nov.	17.2	14.0	15.6	0.81	3.2	5.2
	Dec.	11.0	8.3	9.7	0.74	2.7	7.6
	Jan.	8.5	6.0	7.3	0.71	2.5	9.7
	Feb.	10.1	6.8	8.5	1.49	3.3	17.5
	Mar.	13.2	10.8	12.0	0.82	2.4	6.8
	Apr.	18.5	15.9	17.2	0.86	2.6	5.0
	May	22.5	20.9	21.7	1.55	1.6	7.1
Air temperature (℃)Min.	Oct.	16.2	14.0	15.1	1.29	2.2	8.5
	Nov.	9.8	5.6	7.7	0.57	4.2	7.4
	Dec.	3.3	0.5	1.9	0.21	2.8	11.1
	Jan.	1.0	-1.7	-0.4	1.72	0.7	43.0
	Feb.	3.4	-1.5	1.0	0.45	1.9	45.0
	Mar.	5.6	2.7	4.2	0.48	2.9	11.4
	Apr.	12.2	7.4	9.8	0.61	4.8	6.2
	May	15.6	13.0	14.3	1.26	2.6	8.8
Percipitation (mm)	Oct.	201.0	18.8	110.0	45.5	182.2	41.4
	Nov.	219.5	9.7	114.6	22.2	209.8	19.4
	Dec.	59.6	0.0	29.8	29.2	59.6	97.9
	Jan.	54.0	8.7	31.4	16.1	22.6	51.3
	Feb.	65.1	0.7	32.9	10.7	32.2	32.5
	Mar.	164.2	37.5	100.9	22.8	63.3	22.6
	Apr.	193.1	47.2	96.6	24.4	96.5	25.3
	May	250.1	46.1	148.1	18.3	204.0	12.4
Duration of sunshine (hr)	Oct.	271.9	164.3	218.1	38.4	107.6	17.6
	Nov.	243.1	161.9	202.5	33.3	40.6	16.4
	Dec.	232.0	179.4	205.7	35.1	26.3	17.1
	Jan.	235.6	166.6	201.1	35.3	34.5	17.6
	Feb.	229.4	157.1	193.3	34.2	36.1	17.7
	Mar.	239.2	150.8	195.0	31.5	44.0	16.2
	Apr.	260.4	155.1	207.8	29.8	52.6	14.3
	May	288.0	189.4	238.7	32.9	98.6	13.8

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

Meteorological factors	Month	Culm length(cm)	Spike length(cm)	No. of grains/spike	No. of spikes/m^2	Wt. of 1,000 grains(g)	Seed yield (kg/10a)
Air temperature (℃)Mean	Oct.	0.394*	0.278	0.604**	0.280	0.290	0.351*
	Nov.	0.004	0.004	0.003	0.081	0.002	0.165
	Dec.	0.055	0.013	0.216	0.157	0.107	0.370*
	Jan.	0.425*	0.376*	0.309	0.357*	0.307	0.399*
	Feb.	0.534**	0.488**	0.567**	0.396*	0.440*	0.409*
	Mar.	0.295	0.167	0.458**	0.102	0.117	0.288
	Apr.	0.174	0.103	0.276	0.069	0.135	0.259
	May	0.196	0.140	0.436*	0.227	0.123	0.259
Max.	Oct.	0.655**	0.617**	0.671**	0.574**	0.574**	0.501**
	Nov.	0.152	0.157	0.071	0.124	0.156	0.198
	Dec.	0.121	0.087	0.299	0.259	0.204	0.396*
	Jan.	0.322	0.193	-0.297	0.152	0.193	0.325
	Feb.	0.601**	0.570**	0.580**	0.450**	0.521**	0.439*
	Mar.	0.320	0.154	0.441*	0.084	0.146	0.375*
	Apr.	0.027	-0.018	-0.022	-0.102	0.046	0.112
	May	0.094	0.096	0.300	0.238	0.131	0.183
Min.	Oct.	0.215	0.072	0.474**	0.096	0.119	0.240
	Nov.	0.141	0.133	0.123	0.019	0.117	0.087
	Dec.	0.054	0.001	0.186	0.111	0.084	0.365*
	Jan.	0.442*	0.417*	0.346	0.409*	0.297	0.389*
	Feb.	0.527**	0.481**	0.568**	0.401*	0.456**	0.420*
	Mar.	0.225	0.147	0.362*	0.077	0.101	0.190
	Apr.	0.163	0.073	0.329	0.072	0.085	0.268
	May	0.170	0.084	0.418*	0.198	0.073	0.346
Precipitation (mm)	Oct.	-0.536**	-0.525**	-0.372*	-0.541**	-0.625**	-0.645**
	Nov.	-0.369*	-0.383*	0.289	0.443*	-0.309	-0.501**
	Dec.	-0.179	-0.287	0.006	0.335	-0.286	-0.305
	Jan.	-0.338	-0.294	-0.190	-0.302	-0.397*	-0.575**
	Feb.	-0.198	-0.262	0.141	0.238	-0.326	-0.134
	Mar.	-0.235	-0.114	-0.138	-0.055	-0.266	-0.394*
	Apr.	-0.434	-0.477**	-0.503*	-0.467**	-0.457**	-0.401*
	May	-0.127	-0.163	-0.006	-0.071	-0.105	-0.088
Duration of sunshine (hr)	Oct.	-0.212	-0.342	-0.060	-0.297	-0.313	-0.122
	Nov.	-0.080	-0.052	-0.041	-0.109	-0.044	-0.104
	Dec.	-0.029	-0.006	-0.168	0.027	-0.037	-0.114
	Jan.	-0.028	-0.060	-0.004	-0.037	-0.128	-0.224
	Feb.	-0.290	0.231	-0.354*	-0.288	-0.329	-0.471**
	Mar.	-0.324	-0.178	-0.284	-0.150	-0.229	-0.401*
	Apr.	-0.320	-0.240	-0.502**	-0.277	-0.258	-0.434*
	May	-0.504**	-0.407*	-0.493**	-0.479**	-0.539**	-0.767**

November, December, January, February, March, April and May and yield is shown and there is highly significant negative correlation between duration of sunshine of May and yield, then it is found that small duration of sunshine for the all growth periods of October, November, December, January, February, March, April and May 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 the culm length, spike length, number of grains per spike, number of spikes per m^2, weight of 1,000 grains and yield is shown and the more yield is, the more malting barley yield is.

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Table 5. Correlation coefficients between yield components and yield

Characters	2)	3)	4)	5)	6)
1) Culm length (cm)	0.971**	0.935**	0.932**	0.946**	0.915**
2) Spike length (cm)		0.860**	0.970**	0.968**	0.859**
3) No. of grains/spike			0.854**	0.819**	0.891**
4) No. of spike / m^2				0.950**	0.889**
5) Wt. of 1,000 grains (g)					0.886**
6) Seed yield (kg/10a)					-

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