생명과학회지
Korean J. Life Science, 8(3), 294-298, 1998

Effect of Transplanting Dates and Water Management on the Growth of Adlay(*Coix lachrymajobi* L. var. mayuen)

Sung-Man Kim†, Yong-Chul Kim and In-Soo Choi

Dept. of Agronomy, Miryang National University, Miryang 627-702, Korea

Abstract

The objective of this study was to establish the stable cultivating method of adlay in paddy fields. The effect of soil moisture on the early rootage of the transplanted adlay seedling was evaluated in 1996. The suitable transplanting period and the relationship between water management and leaf blight disease were tested in 1997. The critical transplanting date was June 30. Rooting of transplanted adlay plants was retarded when soil moisture was saturated. However, sufficient soil moisture since one month after transplanting was required for the control of leaf blight disease and high yield of adlay.

Key words : *Adlay, Soil moisture, Transplanting dates, Rooting, Yield*

Introduction

The control of leaf blight disease increases the production of Adlay(*Coix lachrymajobi* L. var. mayuen). However, most of past studies on adlay production have been conducted in upland or hillside, which was inflicted with severe drought damage. Drought inevitably causes leaf blight disease.

The results of recent studies[1,2,5] on adlay show that when the adlay was cultivated under the soaked and irrigated paddy conditions, it tended to adapt the extensive soil moisture content, which suggests that it could be applied to the paddy as well as upland. Under the rice-barley double cropping system, farmers can take advantage of that the rapid growth habit of adlay as a C_4 crop[3] reduces the weed competition and enhances the possibility of substituting rice especially in the area for the lack of water or labor. Despite the desirable characteristics of adlay, it has only been regarded as a upland and medicinal crop[7] that inflicted with leaf blight disease. Thus, the cultivation of adlay has been restricted to small area in South Korea.

The objective of this study was to establish the stable cultivating method of adlay in paddy field which has been forsaken due to the lack of labor or unprofitable for the cultivation of rice.

Materials and Methods

The experiment was performed at the field and laboratory of Miryang National University from March, 19 96 to October, 1997. Two seedlings of adlay var. aewonyulmu were transplanted at 60×50×120㎤ pots on May 20, 1996. They were transplanted with 30cm row width and 20cm apart in the row. Characteristics of seedlings are shown in Table 1.

† Corresponding author

Table 1. Characteristics of the transplanted seedlings

Nursing days	Leaf length (cm)	No. of leaf	No. of roots per plant	Dry Wt. (g/30 plants)
20	18.7	2.0	7.8	4.1

The fertilizer was applied the whole amounts as basal fertilization, and levels were N ; 12kg, P_2O_5 ; 10kg, K_2O ; 12kg per 12㎡, respectively. Three water managements ; drainage after transplanting, soaked soil moisture, and 3cm high irrigation were used.

In 1997, 20 day-grown-seedlings were transplanted on three different days ; May 20, June 20, and July 20. Seedlings were treated with drainage after transplanting and 3cm high irrigation after rootage. The experiment design was split-plot design with 3 replications. Transplanting density was 60cm wide row spacing with plants 20cm apart in the row. Fertilizer levels were N ; 1.2kg, P_2O_5 ; 1.0kg, K_2O ; 1.2kg, respectively. Half of N and K_2O was applied as basal and the remaining half was as top dressing at the heading stage.

Results and Discussion

Effect of water management after transplanting on the early growth of adlay

Changes of leaf length and number of tillers in 3 soil moisture conditions(drainage, soak, and irrigation) for 4 different days after transplanting(June 15, June 25, July 5, July 15) in 1996 are shown in Table 2.

In general, early growth of transplanted plants were retarded. It was noticed that rooting began earlier in young seedlings than old ones. This suggests the necessity of further research about the relationship between duration of nursery and rooting after transplanting. Better rooting of seedlings just after transplanting was observed in drainage than soaking or irrigated soil moisture conditions. However, there was no significant difference in rooting between drainage, soaked, or irrigated conditions in one month or later after transplanting. It is proposed that the difference in rooting was caused by the fact that roots of seedlings transplanted in the soaked and irrigated plots were regenerated after the seminal roots were died while the seedlings transplanted in the drained plot regrew at the seminal and adventitious roots.

Comparisons of growth stages and yield on transplanting date and soil moisture conditions

1) Maximum tillering time, heading date, and harvesting time : Results of maximum tillering time, heading date, and harvesting time are shown in Table 3. Maximum tillering time showed little difference between irrigated and drained soil moisture conditions. However, heading date of plants on irrigated condition was dela-

Table 2. Leaf length and number of tillers in 3 soil moisture conditions for 4 different days after transplanting

Soil Moisture	Leaf Length(cm)				No. of tillers(stand/㎡)			
	Jun. 15	Jun. 25	Jul. 5	Jul. 15	Jun. 15	Jun. 25	Jul. 5	Jul. 15
Drainage	20	31	38	45	2.5	3.1	3.8	4.3
Soak	15	26	35	44	2.0	21.7	3.4	4.4
Irrigation	13	21	30	42	1.8	2.1	3.2	4.2

Table 3. Growth stages on transplanting date and soil moisture conditions

Transplanting date	Soil moisture condition	Maximum Tillering date	Heading date	Days from transplanting to heading	Harvesting date	Days from heading to harvest
May 20	Drainage	Jul. 10	Jul. 20	61	Sep. 20	62
	Irrigation	Jul. 10	Jul. 26	67	Sep. 25	61
June 20	Drainage	Aug. 1	Aug. 8	49	Oct. 7	61
	Irrigation	Aug. 2	Aug.12	53	Oct.10	60
July 20	Drainage	Aug. 2	Aug.31	42	Oct.25	54
	Irrigation	Aug.20	Sep. 5	47	Oct.30	54

Table 4. Yield, yield components, and leaf blight damage on transplanting date and soil moisture conditions

Transplanting date	Water management	Plant height (cm)	No. of grain holding tillers per ㎡	No. of grains per ㎡	Grain-filling rate	Wt. of 1,000-grains (g)	Leaf blight damage
May 20	Drainage	184	137	6012	75	101.7	Medium
	Irrigation	176	141	6144	85	103.4	Light
June 20	Drainage	180	145	6058	76	102.8	Medium
	Irrigation	172	140	6127	85	104.8	Light
July 20	Drainage	156	115	4322	61	87.8	Severe
	Irrigation	147	107	4457	63	88.2	Medium

yed about 4 to 6 days than those on drained condition.

The durations from transplanting to heading date upon transplanting date were 64 days for May 20, 51 days for June 20, and 45 days for July 20. This result indicates that duration from transplanting to heading date was decreased as the transplanting date was late. Previous studies reported that duration from transplanting to heading date was drastically decreased as the transplanting date was late.[5, 7)]

Grain filling period and harvesting time on transplanting date showed similiar tendency as heading date, which means that duration from transplanting to grain filling period and harvesting time were decreased as the transplanting date was late. Especially, adlay plants transplanted on July 20 were not be able to harvest without frost damage in the late fall.

2) Yield and yield components : The highest number of grain-holding tillers was observed in the plants transplanted on June 20. In the comparison of the number of grain-holding tillers on water management, higher number of grain-holding tillers were observed in irrigated plot than in drained for the plants transplanted on May 20 and June 20. But, higher number of grain-holding tillers were observed in drained plot than in irrigated for the plants transplanted on July 20. This result might be caused by that the plants could not have enough time the growth due to the late transplanting.

Number of grains on transplanting time did not show significant difference between May 20 and June 20 while those transplanted on July 20 were sharply decreased. And, higher number of grains were obtained from irrigated soil moisture condition than drained condition, which suggests the desirable characteristic for machinery harvest.

Table 5. Grain yields on transplanting dates

Transplanting date	Grain yield per 10a(kg)
May 20	624
June 20	647
July 20	454

Table 6. Grain yields on water management

Water management	Grain yield per 10a(kg)
Drainage	553
Irrigation	596

Grain-filling rate and weight of 1,000-grains were increased by irrigation for the plants transplanted before June 20, but were decreased for the plants transplanted on July 20.

Damage from leaf blight for the plants on irrigated soil moisture condition was decreased than on drained condition. Several previous studies[2,4,6] have already reported that leaf blight disease was prevented by irrigation in the cultivation of adlay.

Grain yield on transplanting dates is shown in Table 5. Grain yield of adlay transplanted on May 20 and June 20 were 624 and 647 kg/10a, respectively. And, that transplanted on July 20 was 454 kg/10a. This result indicates that early transplanting had good effect for high grain yield. Grain yield on water management is shown in Table 6. Grain yield from irrigated soil moisture condition was 596 kg/10a, and that from drained condition was 553 kg/10a, which suggests that irrigated soil moisture condition had better effect for high grain yield than drained condition. Kim et al.[2] have reported that both early sowing and sufficient soil moisture were the key for high yield of adlay as far as the mean temperature was over 15℃. On the meanwhile, Inoue et al.[5] reported that early transplanted adlay plants were afflicted with more severe leaf blight and consequently grain yield was decreased. Thus, further study for grain yield on transplanting dates and water management are needed.

References

1. Abe K., Kato Y., Takuma H. and Murakami M. : Establishment of cultivation of the "Hatomugi"(*Coix ma-yuen* Roman) transplanted in paddy field. *Bull. Fukuoka Agric. Res. Cent.* A-7, 61~66(1986).
2. Kim J. T., Kwack Y. H. and Kim Y. C. : Growth and yield of Job's Tears(*Coix lacryma-jobi* L.) at different planting density and time under dry and flooded paddy field. *Korean J. Crop Sci.* **41**, 558~562(1996).
3. Takefumi O., Yano M., Fujii H. and Tanaka S. : Direct sowing culture of Job's Tear(*Coix Lacryma-jobi* L. var. *frumentacea* Makino) after wheat crop. *Bull. Fukuoka Agric. Res. Cent.* A-10, 55~58(1987).
4. Sasaki S., Kutsuno Y. and Terayama Y. : Studies on the stable cultivations of Job's tears(*Coix Ma-yuen* Roman) in paddy field. *Res. Bull. Aichi Agric. Res. Ctr.* **16**, 69~72(1986).
5. Inoue T., Izawa T., Nakajima Y, Kutsuna Y, Kato Y. and Taniguchi M. : Studies on the mechanical cultivation of Job's Tears(*Coix lacryma-jobi* L.) - Nursery period, transplanting density and time. *Res. Bull. Aichi Agric. Res. Ctr.* 16, 73~84(1986).
6. Watanabe T., Takeichi Y. and Tsuruoka M. : Cultivation method of Job's Tears(*Coix Lacryma Jobi* L. *var Frumentacea* Makino) in paddy fields. *Bull Chiba Agric. Exp. Stn.* **24**, 31~34(1983).
7. Kim Y. C. and Lee J. T. : Correlations among some characters by different seedling dates in pearl barley. *KNU.* 3, 50~56(1975).

초록 : 移植時期 및 本畓 물 管理方法이 율무 生育에 미치는 影響

김성만† · 김용철 · 최인수
(밀양산업대학교 농학과)

本 硏究는 移植時期와 물管理 方法이 율무의 收量에 미치는 影響을 알아보기 위함이었는데, 그 結果는 아래와 같이 要約된다.

1. 율무의 移植後 初期生育은 排水處理球에서 양호하였고 湛水處理區는 移植 1個月 以後 부터 생육이 점차 회복되었다.

2. 移植時期가 늦어질수록 移植~出穗까지의 기간이 크게 단축되었으며 율무의 제특성 발현 및 첫서리 이전에 수확을 하기 위해서는 6월 20일이 율무 移植限界期였다.

3. 율무는 湛水 재배조건하에서 간장은 단축되었으나 결실립수 및 1,000립중은 증가하였 으며, 葉枯도 감소되어 排水처리구에 비해 種實收量이 8% 증수되었다.