

지베렐린 생합성 억제제 Uniconazole과 Inabenfide를 이용한
벼의 영양생장調節과 그에 따른 收量變化

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Modulation of Vegetative Growth of Rice with Gibberellin Biosynthesis
Inhibitors Uniconazole and Inabenfide for Higher Yield

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실험목적: 密植多肥栽培를 통한 벼의 收量性 向上에 있어서 群落의 過繁茂와 倒伏의 發生은 收量の 安定性을 잃게하고 있다. 한편 벼 栽培에 있어서 倒伏 輕減劑로 사용되는 지베렐린生合成 抑制劑들은 節間伸長期에 처리하여 稈長을 단축시키므로서 倒伏輕減 効果는 얻을 수 있으나 일반적으로 穗長과 1穗 穎花數가 다소간 감소되므로, 도복하지 않을 경우에는 오히려 減收시키기 쉽다. 따라서 本 研究는 벼의 營養生長期인 分蘗期 및 無效分蘗期에 지베렐린生合成 抑制劑를 처리하여 營養生长期를 調節하므로서 倒伏 危險性을 줄이고 安全多收 할 수 있는가 하는 可能性을 검토하고자 수행하였다.

재료 및 방법: 一般系 品種 東津벼를 사용하여 28.5株/m²로 栽植하였으며, 窒素施肥를 10 kg/10a와 15 kg/10a의 2수준에서, uniconazole과 inabenfide를 處理時期와 量을 달리하여 處理하고, 그가 벼의 生育 및 收量에 미치는 影響을 조사하였다. 그 結果를 要約하면 다음과 같다.

결과 및 고찰: Uniconazole과 inabenfide는 草長과 稈長을 감소시켰으며, 處理時期가 늦어질수록, 處理量이 증가함에 따라 감소정도는 커졌다. 현재 倒伏 輕減劑로 推薦되는 대로 uniconazole을 出穗前 15日에 1.2g ai/10a, inabenfide를 出穗前 25日에 150g ai/10a를 처리한 경우 uniconazole과 inabenfide는 窒素水準에 따라 각각 초장을 6.3 ~ 7.5%, 5 ~ 6%, 간장을 7.5 ~ 13.8% 및 4 ~ 7% 단축시켰다. 한편 이양 후 25日 以內의 分蘗期 處理도 出穗期에 草長과 稈長을 無處理에 비해 uniconazole의 경우 각각 3 ~ 8% 및 2 ~ 11% 단축시켰고, inabenfide의 경우 각각 4 ~ 8% 및 1 ~ 3% 단축시켰다. Uniconazole과 inabenfide의 草長 및 稈長의 단축효과는 窒素施肥量이 많은 경우 작았다. 分蘗初期에서 節間伸長期前까지의 uniconazole과 inabenfide 處理로 草長과 稈長은 단축되었고 穗長과 1穗 穎花數에는 影響하지 않았다. 最高分蘗期 以後에 처리한 경우에는 草長과 稈長의 단축정도가 커지고 그와 함께 穗長과 1穗 穎花數가 뚜렷이 감소하였고, 草長과 稈長, 稈長과 穗長, 穗長과 1穗 穎花數 間에는 모두 正의 相關을 보였으며, 相關程度는 N 10 kg 區에서 N 15 kg 區에 비해 컸다. Uniconazole과 inabenfide를 分蘗期에 처리하였을 때 分蘗과 穗數는 uniconazole에서는 2 ~ 19% 및 -4 ~ 10%, inabenfide에서는 6 ~ 34% 및 6 ~ 20% 增減하였으며, N 15 kg/10a 區에서 보다는 N 10 kg/10a 區에서 增加效果가 컸으며, uniconazole에 비해 inabenfide의 增加效果가 컸으며, 특히 N 10kg/10a 區에서 分蘗盛期인 이양 후 20日에 inabenfide를 150g ai/10a 처리하였을 때 無處理에 비해 分蘗과 穗數가 각각 34%, 21%로 增加하였다. 지베렐린生合成 抑制劑의 分蘗期 處理로 穗長 및 1穗 穎花數의 감소없이 營養生长期間中의 草長과 分蘗, 出穗期 以後의 稈長, 穗數 및 葉面積指數, 草型, 葉의 老化를 모두 多收에 유리한 방향으로 多少間 調節할 수 있었으며, 倒伏의 危險性도 減少하여 uniconazole을 處理한 경우에는 10%, inabenfide를 處理한 경우에는 16% 增收하였다. 또한 增收效果는 N 10 kg/10a 區에서 높았다.

Table 1. Effect of application of uniconazole before the maximum tiller stage on the plant height, culm length and number of tillers of paddy rice under two levels of nitrogen.

Application (kg ai / 10a)	nitrogen method	Plant height(cm)		Culm length(cm)		No. of tillers(/hill)						
		3SDAT	Heading	Heading	3SDAT	Heading	(/a)					
Untreated	T0	46.30*	100.0	90.80*	100.0	64.47*	100.0	12.30*	100.0	10.15*	288.4*	100.0
	T1	43.10*	98.09	87.35*	96.20	58.70*	91.05	13.00*	105.7	10.25*	282.0*	101.2
	T2	42.25*	91.25	87.35*	96.20	59.43*	92.18	13.50*	110.4	11.16*	317.5*	110.1
	T3	40.05*	86.50	83.40*	91.85	57.33*	88.93	13.50*	109.8	10.00*	307.6*	103.7
Untreated	T4	52.35*	100.0	95.15*	100.0	68.37*	100.0	18.40*	100.0	13.25*	377.4*	100.0
	T1	49.80*	95.13	92.00*	96.69	66.83*	97.76	18.70*	101.6	12.70*	363.2*	96.23
	T2	48.35*	92.36	91.50*	96.16	65.40*	97.12	21.85*	119.3	14.25*	405.9*	107.6
	T3	48.75*	93.12	90.70*	95.32	65.53*	95.85	19.83*	108.3	14.10*	401.6*	106.4
F test nitrogen		198.6**		85.99**		45.99**		279.05**		608.31**		808.43**
application		11.00*		(1.21)		(2.09)		(0.80)		(6.56)		(8.69)
application		19.21*		21.24*		4.61*		7.47**		21.69**		21.87**
		(1.42)		(1.90)		(2.92)		(2.01)		(6.93)		(9.83)

* : days after transplanting. T1: 100DAT(0.6g ai/10a), T2: 200DAT(1.2g ai/10a), T3: 100DAT+250DAT(0.6g ai/10a+0.6g ai/10a)

Table 2. Effect of additional application of uniconazole after the maximum tiller stage on the plant height, culm length and number of tillers of paddy rice under two levels of nitrogen.

Application (kg ai / 10a)	nitrogen method	Plant height		Culm length		No. of spikelets	
		(cm)	E.A.(%)	(cm)	E.A.(%)	(/hill)	(/a)
Untreated	T0	90.80*	100.0	64.47*	100.0	10.13*	288.4
	T4	82.80*	91.19	55.87*	86.50	5	18.40
	T5	82.10*	90.62	56.20*	87.17	5	10.65
	T6	81.80*	90.09	54.00*	83.76	5	18.90
T7	83.85*	92.46	55.53*	86.13	10.10	287.7	
Untreated	T4	95.15*	100.0	68.37*	100.0	13.25*	377.4
	T5	88.35*	92.85	64.70*	94.63	3	13.75
	T6	86.80*	91.84	64.10*	93.75	3.5	14.25
	T6	84.90*	88.23	61.80*	91.56	4	14.33
T7	89.15*	93.69	63.20*	92.44	13.30	378.8	
F test nitrogen		18.50**		72.32**		162.90**	
application		2.39**		(1.81)		(0.54)	
application		3.39**		10.20**		(15.31)	
		(3.61)		(2.88)		NS	

* : Effect of additional treatment, (ineffective tillering stage/ effective tillering stage)100.

** : Recommended application time to prevent rice crop from lodging.

T4: 100DAT+100DAT(0.6g ai/10a+0.6g ai/10a), T5: 200DAT+100DAT(0.6g ai/10a+0.6g ai/10a), T6: 100DAT+250DAT+100DAT(0.6g ai/10a+0.6g ai/10a+0.6g ai/10a), T7: 100DAT(1.2g ai/10a)

(): LSD 5%

Table 3. Effect of application of isabenzide before the maximum tiller stage on the plant height, culm length and number of tillers of paddy rice under two levels of nitrogen.

Application (kg ai / 10a)	nitrogen method	Plant height(cm)		Culm length(cm)		No. of tillers(/hill)	
		3SDAT	Heading	Heading	3SDAT	Heading	(/a)
Untreated	T0	46.30*	100.0	90.80*	100.0	64.47*	100.0
	T1	45.18*	97.82	86.90*	95.70	64.30	99.58
	T2	45.05*	97.30	86.70*	95.49	64.00	99.27
	T3	44.20*	95.46	84.65*	92.57	63.20	98.03
Untreated	T4	52.35*	100.0	95.15*	100.0	68.37*	100.0
	T1	50.85*	97.13	94.15*	98.95	67.63	98.92
	T2	49.15*	93.89	91.20*	95.85	67.13	98.19
	T3	49.80*	93.22	89.20*	93.30	66.47	97.22
F test nitrogen		264.2**		46.44**		12.79**	
application		(0.63)		(1.94)		(2.01)	
application		7.70**		17.03**		NS	
		(1.13)		(1.90)		(1.43)	

* : days after transplanting.

T1: 100DAT(75g ai/10a), T2: 200DAT(150g ai/10a), T3: 100DAT+250DAT(75g ai/10a+75g ai/10a)

Table 2. Effect of additional application of isabenzide maximum tiller stage on the plant height, culm length and number of tillers of paddy rice under two levels of nitrogen.

Application (kg ai / 10a)	nitrogen method	Plant height		Culm length		No. of spikelets	
		(cm)	E.A.(%)	(cm)	E.A.(%)	(/hill)	(/a)
Untreated	T0	90.80*	100.0	64.47*	100.0	10.13*	288.4
	T4	84.35*	92.90	62.43*	96.84	3	11.80*
	T5	84.05*	93.01	61.70*	95.70	2	12.40*
	T6	87.70*	96.59	61.83*	95.91	10.65*	303.4
Untreated	T4	95.15*	100.0	68.37*	100.0	13.25*	377.4
	T5	87.80*	92.22	65.89*	95.80	3	14.10*
	T6	88.65*	93.76	64.83*	94.97	2	14.60*
	T6	89.65*	94.22	64.57*	94.88	13.45*	383.1
F test nitrogen		28.81**		18.57**		219.36**	
application		(1.39)		(1.85)		(0.36)	
application		7.14**		NS		22.14**	
		(1.96)				(0.51)	

* : Effect of additional treatment, (ineffective tillering stage/ effective tillering stage)100.

** : Recommended application time to prevent rice crop from lodging.

T4: 100DAT+100DAT(75g ai/10a+75g ai/10a), T5: 100DAT+250DAT(75g ai/10a+75g ai/10a), T6: 250DAT(150g ai/10a)

(): LSD 5%

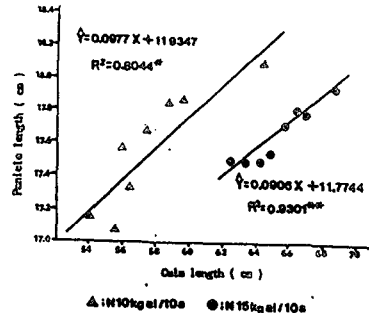


Fig. 1. Relationship between culm length and panicle length as affected by application of uniconazole under two levels of nitrogen.

Table 3. Effect of application of uniconazole on grain yield and yield components of paddy rice under two levels of nitrogen.

Application method	nitrogen (kg ai / 10a)	No. of spikelets (x10³/hill)	Spikelet grain weight (g)	1000 grain weight (g)	Grain yield (kg/10a)	Grain yield index	
							Untreated
T1	21.12*	100.9	91.77	25.06	493.0*	100.6	
T2	22.69*	108.2	93.62	24.71	508.0*	110.0	
T3	22.00*	105.4	92.78	25.21	518.0*	110.6	
T4	20.13*	98.13	92.69	25.23	498.9*	101.2	
T5	20.45*	97.66	91.44	24.28	466.3*	101.0	
T6	20.77*	99.19	94.83	24.07	470.1*	101.8	
T7	19.85*	94.99	92.67	23.22	424.3*	91.92	
Untreated	T4	25.97*	100.0	89.30	23.84	505.1*	100.0
	T1	26.21*	101.3	88.65	23.45	521.0*	99.0
	T2	25.49*	102.0	88.13	23.84	543.0*	107.3
	T3	26.00*	100.4	90.71	23.88	529.9*	104.7
	T4	26.12*	100.6	88.95	23.84	525.9*	103.8
	T5	27.14*	104.6	85.19	23.82	517.7*	102.3
	T6	27.00*	104.3	88.91	23.83	531.2*	105.4
T7	25.15*	98.94	91.05	24.70	522.8*	103.9	
F test nitrogen		191.67**		28.17**		49.61**	
application		(0.77)		(1.04)		(0.25)	
application		2.27**		NS		3.00**	
		(1.94)				(28.41)	

* : Recommended application time to prevent rice crop from lodging.

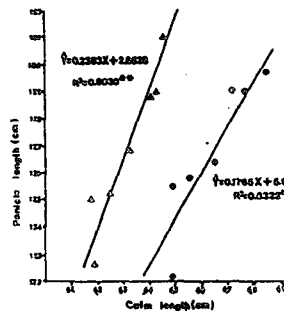


Fig. 1. Relationship between culm length and panicle length as affected by application of isabenzide under two levels of nitrogen.

Table 3. Effect of application of isabenzide on grain yield and yield components of paddy rice under two levels of nitrogen.

Application method	nitrogen (kg ai / 10a)	No. of spikelets (x10³/hill)	Spikelet grain weight (g)	1000 grain weight (g)	Grain yield (kg/10a)	Grain yield index	
							Untreated
T1	23.47*	112.1	88.79*	24.64*	496.9*	100.0	
T2	24.95*	119.2	89.17*	24.07*	518.0*	112.3	
T3	24.00*	114.6	88.60*	25.27*	525.9*	110.0	
T4	23.43*	111.9	88.95*	24.19*	491.0*	100.6	
T5	24.82*	117.1	85.89*	23.89*	486.9*	100.4	
T6	20.37*	97.28	82.49*	25.25*	459.2*	95.48	
Untreated	T4	25.97*	100.0	89.30*	23.84*	505.1*	100.0
	T1	26.25*	102.2	88.66*	23.85*	523.0*	103.3
	T2	26.69*	110.3	90.79*	23.89*	537.1*	105.1
	T3	26.49*	101.7	92.76*	24.29*	536.1*	104.7
	T4	26.69*	99.63	90.30*	24.33*	532.4*	104.2
	T5	26.85*	103.4	88.60*	23.64*	527.4*	104.2
	T6	24.63*	94.84	86.33*	23.43*	494.7*	95.78
F test nitrogen		95.57**		17.45**		11.63**	
application		(0.63)		(0.36)		(14.44)	
application		8.30**		2.71**		4.19**	
		(1.19)		(2.63)		(0.62)	

* : Recommended application time to prevent rice crop from lodging.