

殺菌劑 Hexaconazole이 水稻 生育에 미치는 Anti-Gibberellin의 效果

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Anti-Gibberellic Effect of Fungicide Hexaconazole on the Growth and Yield of Rice

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실험 목적 : 殺菌劑 hexaconazole이 여러 triazole系 農藥 중에서도 Anti-GA機能을 갖는 paclobutrazol 및 uniconazole과 化學構造가 매우 비슷하며 벼 농사에 있어서 잎집무늬마름병약으로 이미 登錄 사용되고 있으므로 이 藥劑의 Anti-GA 機能 有無를 檢討하고, Anti-GA의 기능이 있을 경우 벼 농사에서 倒伏輕減劑로 쓰이고 있는 既存의 Anti-GA化合物들의 效能과 比較하여 도복경감제로서의 利用 可能性과 適切한 使用時期 및 使用량을 밝히고자 하였다.

재료 및 방법 : Hexaconazole을 種戶 및 幼苗에 처리하였을 때 나타나는 生育反應을 倒伏輕減劑이며 Anti-GA인 inabenfide, paclobutrazol, uniconazole을 처리하였을 때의 生育반응과 比較하여 그의 類似性을 통해 hexaconazole의 Anti-GA 機能 有無를 檢討하였고, 實際 圃場에서는 藥量과 處理時期를 달리하여 hexaconazole 및 inabenfide, paclobutrazol, uniconazole을 처리하였고, 각 약제에 대한 벼의 生育 및 收量에 미치는 影響을 調査하여 比較하였다.

결과 요약

1. 볏씨 發芽中 α -amylase 誘起를 10%抑制하는 處理濃度는 hexaconazole은 $1.1 \times 10^{-4}M$ 이었고 inabenfide는 $9.7 \times 10^{-3}M$, paclobutrazol과 uniconazole은 각각 $2.1 \times 10^{-7}M$ 및 $1.2 \times 10^{-7}M$ 이었다.
2. 幼苗의 葉生長에 대해 hexaconazole은 inabenfide 및 uniconazole과 外形上 同質의 藥劑處理效果를 보였고, 第2葉期 幼苗에 莖葉處理를 1회하였을 경우 葉伸長抑制效果는 $1 \times 10^{-3}M$ 濃度에서 hexaconazole 28%, uniconazole 37%, inabenfide 22%이었다.
3. 어린모를 移秧栽培하고 分蘗盛期 및 後期, 出穗前 40日~15日에 hexaconazole, inabenfide, uniconazole을 처리하였을 경우 莖葉의 葉綠素含量 增加, 草長의 短縮, 分蘗의 增加, 稈長의 短縮, 節稈의 挫折重 增加 등 모든 生育反應에 있어서 hexaconazole은 Anti-GA의 效果를 보였는데 대체로 hexaconazole 200~300g a.i./ha 처리는 inabenfide 1200g a.i./ha 및 uniconazole 12g a.i./ha 處理效果와 比等하였고 莖葉의 葉綠素含量 持續效果는 inabenfide 및 uniconazole보다 多少 길었다.
4. 벼 品種 화성벼와 일품벼를 供試한 2년간의 圃場實驗에서 어린모를 移秧한 후 25日~35日에 hexaconazole, inabenfide 또는 uniconazole을 適量 처리하는 경우 有效分蘗數가 增加하고 葉綠素含量이 登熟期까지 높게 維持되면서도 草長 및 稈長이 10%정도 短縮되고, 稈의 挫折重이 增加하고 倒伏指數가 減少하여 倒伏輕減效果가 뚜렷할 뿐 만 아니라 收量도 10%정도 增加하였다.
5. Hexaconazole, inabenfide 및 uniconazole은 處理時期가 出穗前 40日이후 出穗期에 가까운 時期에 處理할수록 稈長短縮效果는 커지나 穗長 및 穎花數의 減少, 그에 따른 收量減少의 危險이 증가하였다.
6. Hexaconazole은 以上の 여러 結果로 보아 paclobutrazol, uniconazole 및 inabenfide와 매우 비슷한 GA合成 抑制作用性을 갖고 있으며 그 力價(potency)는 inabenfide보다는 뚜렷이 크고 paclobutrazol이나 uniconazole보다는 뚜렷이 작으며, 벼 栽培에 있어서 倒伏輕減劑 및 生育調節劑로 活用할 수 있다고 생각한다.

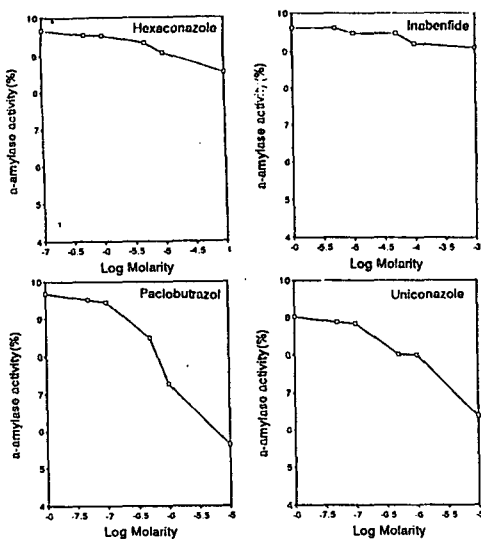


Fig 1. Effect of hexaconazole and Anti-GAs on the induction of α -amylase in germinating rice seeds. α -amylase activity(%) means the percent of starch broken down by enzyme extract for one minute and was calculated as following equation :

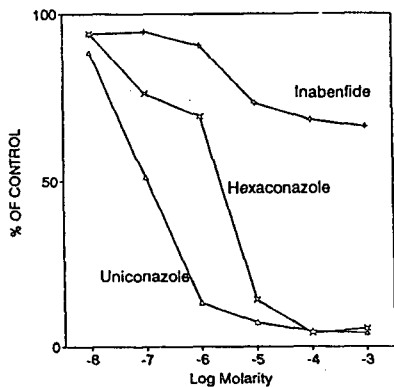


Fig 4. Relative inhibition of shoot elongation for 10 days of the rice seedlings by hexaconazole and Anti-GAs treated to the progerminated seeds.

Table 8. Effect of hexaconazole and Anti-GAs on the panicle length, culm length and number of spikelets per panicle in the rice plants, cv. Ithasung.

Chemical	Application time	Dose (g a.i./10a)	Culm length (cm)	Panicle length (cm)	No. of spikelets /panicle
Early Application					
Untreated	-	-	87.3a	20.6a	84.3b
Hexaconazole	25DAT	19.4	84.9ab	22.1a	88.3a
	25DAT	38.7	81.9bc	21.2a	88.1a
	25DAT	58.1	79.6c	21.0a	84.4b
Inabenfide	25DAT	120	81.0c	22.1a	84.5b
Late Application					
Untreated	-	-	87.3a	20.6a	84.3b
Hexaconazole	40DBH	19.4	84.5bc	21.4a	84.9b
	40+25DBH	19.4+19.4	81.2c	21.0a	84.3b
	25DBH	38.7	86.3ab	21.6a	85.1ab
	25+15DBH	19.4+19.4	85.7cb	21.2a	82.3bc
Inabenfide	15DBH	19.4	88.9a	20.8a	85.4ab
	40DBH	120	75.5d	19.9b	85.3ab
Uniconazole	15DBH	1.2	81.3c	19.7b	79.2c

• : DAT (Days after transplanting)
 DBH (Days before heading)
 * (Split treatments)
 Duncan's multiple range test ($\alpha=0.05$).

Table 5. Effect of hexaconazole and Anti-GAs on plant height and tiller number in the rice plants cv. Ithasung.

Chemical	Application time	Dosage (g a.i./10a)	Plant Height (cm)			Tiller Number/Hill		
			7/5	8/15	8/15	7/5	7/25	8/15
Early Application								
Untreated	-	-	74.5a	82.0a	108.0a	20.0a	18.8b	17.3b
Hexaconazole	25DAT	19.4	74.3a	81.5a	108.5a	22.3a	21.5a	21.1a
	25DAT	38.7	73.9a	78.5b	103.3b	20.5a	18.6b	19.9a
	25DAT	58.1	72.7b	77.9b	100.3c	21.0a	18.9b	19.6a
Inabenfide	25DAT	120	71.7b	77.4b	101.6bc	20.5a	21.1a	20.6a
Late Application								
Untreated	-	-	-	-	108.0a	-	-	17.3b
Hexaconazole	10DBH	19.4	-	-	104.2b	-	-	18.9a
	40+25DBH	19.4+19.4	-	-	100.8c	-	-	18.8a
	25DBH	38.7	-	-	105.1ab	-	-	18.2ab
	25+15DBH	19.4+19.4	-	-	104.8b	-	-	17.8ab
Inabenfide	15DBH	19.4	-	-	106.4ab	-	-	18.0ab
	40DBH	120	-	-	95.8d	-	-	18.8a
Uniconazole	15DBH	1.2	-	-	101.1c	-	-	18.2ab

• : heading stage
 •• : DAT (Days after transplanting)
 DBH (Days before heading)
 * (Split treatments)
 Duncan's multiple range test ($\alpha=0.05$).

Table 6. Effect of hexaconazole and Anti-GAs application on the content of chlorophylls of leaf-blades in cultivar Ithasung. (Unit : mg/g fresh weight)

Chemical	Application time	Dosage (g a.i./10a)	0 DAH [†]			20 DAH [†]			40 DAH [†]		
			Flag	2nd	3rd	Flag	2nd	3rd	Flag	2nd	3rd
Early Application											
Untreated	-	-	4.22c	4.48b	4.55b	3.77a	3.87b	3.78c	2.50a	2.16a	2.32a
Hexaconazole	25DAT	19.4	5.98a	6.40a	6.43a	4.40a	4.58a	4.33a	2.71a	2.52a	2.56a
	25DAT	38.7	5.82a	6.11a	6.37a	4.13a	4.23b	4.30ab	2.72a	2.54a	2.57a
	25DAT	58.1	5.92a	6.40a	6.83a	3.82a	4.00b	3.94bc	2.58a	2.23a	2.38a
Inabenfide	25DAT	120	4.53b	4.42b	4.55b	3.81a	3.87b	3.77c	2.57a	2.33a	2.37a
Late Application											
Untreated	-	-	4.22b	4.48b	4.55b	3.77a	3.87a	3.78a	2.50a	2.16a	2.32a
Hexaconazole	40DBH	19.4	6.66a	7.01a	7.31a	3.94a	4.00a	3.97a	2.54a	2.15a	2.07a
	40+25DBH	19.4+19.4	7.38a	7.20a	7.02a	3.83a	3.96a	3.85a	2.71a	2.25a	2.28a
	25DBH	38.7	6.89a	7.06a	7.51a	4.12a	4.10a	4.02a	2.69a	2.53a	2.53a
	25+15DBH	19.4+19.4	6.57a	6.88a	7.04a	3.87a	4.00a	3.96a	2.73a	2.48a	2.33a
Inabenfide	15DBH	19.4	6.76a	7.25a	7.37a	4.17a	4.14a	3.96a	2.67a	2.44a	2.36a
	40DBH	120	4.16b	4.37b	4.62b	3.87b	3.86a	3.79b	2.87a	2.39a	2.49a
Uniconazole	15DBH	1.2	6.78a	7.19a	7.30a	3.89a	3.95a	3.80a	2.58a	2.23a	2.13a

• : DAH (Days after heading)
 •• : DAT (Days after transplanting)
 DBH (Days before heading)
 * (Split treatments)
 Duncan's multiple range test ($\alpha=0.05$).

Table 7. Effect of hexaconazole and Anti-GAs on the lodging index and the breaking strength in the rice plants, cv. Ithasung.

Chemical	Application time	Dosage (g a.i./10a)	Lodging index (b)	Breaking strength (g)
Early Application				
Untreated	-	-	126.2(100) ^{††}	777.3(100)
Hexaconazole	25DAT	19.4	112.8(89.4)	895.3(115.2)
	25DAT	38.7	117.4(93.0)	851.2(109.5)
	25DAT	58.1	119.8(94.9)	830.7(106.9)
Inabenfide	25DAT	120	112.5(89.1)	907.9(116.8)
Late Application				
Untreated	-	-	126.2(100)	777.3(100)
Hexaconazole	40DBH	19.4	110.6(87.6)	952.5(122.5)
	40+25DBH	19.4+19.4	107.8(84.6)	850.3(109.4)
	25DBH	38.7	99.7(79.0)	1027.0(132.1)
	25+15DBH	19.4+19.4	99.5(78.8)	1152.0(148.2)
Inabenfide	15DBH	19.4	122.0(96.7)	812.0(104.5)
	40DBH	120	102.7(81.4)	892.1(114.8)
Uniconazole	15DBH	1.2	108.6(86.1)	914.8(117.7)

• : DAT (Days after transplanting)
 DBH (Days before heading)
 * (Split treatments)
 •• : % of the untreated.

Table 9. Effect of hexaconazole and Anti-GAs on the grain yield and yield components in the rice plants, cv. Ithasung.

Chemical	Application time	Dosage (g a.i./10a)	No. of panicles /panicle	No. of spikelets /panicle	Ripened grain (%)	1000 grain weight	Yield (kg/10a)
Early Application							
Untreated	-	-	358	84.3	86.5	25.3	660.5(100.0) ^{††}
Hexaconazole	25DAT	19.4	384	88.3	86.4	24.3	733.0(111.0)
	25DAT	38.7	382	88.1	87.2	24.2	710.5(107.6)
	25DAT	58.1	360	84.4	87.5	25.4	675.6(102.3)
Inabenfide	25DAT	120	390	81.5	86.4	25.1	714.8(108.2)
Late Application							
Untreated	-	-	358	84.3	86.5	25.3	660.5(100.0)
Hexaconazole	40DBH	19.4	374	84.9	87.9	25.6	714.8(108.2)
	40+25DBH	19.4+19.4	376	84.3	85.7	24.8	674.0(102.0)
	25DBH	38.7	366	85.1	85.2	24.7	692.8(104.0)
	25+15DBH	19.4+19.4	366	82.3	86.6	25.2	659.8(99.9)
Inabenfide	15DBH	19.4	364	85.4	86.0	25.8	697.5(105.6)
	40DBH	120	378	85.3	85.1	24.9	710.5(107.0)
Uniconazole	15DBH	1.2	368	79.2	86.8	25.1	698.2(105.0)

• : DAT (Days after transplanting)
 DBH (Days before heading)
 * (Split treatments)
 •• : % of the untreated.