# 玉米臺農351號耐水性之初步研究[1]

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爲紓解稻米生產過剩所引起政府財政與倉容壓力及稻米外銷困難等諸問題，行政院乃核准從民國七十三年起進行六年之稻田轉作計劃(3)。政策執行以來，由於臺農351號玉米確有高產潛力，每公頃平均產量在六公噸以上，甚至在民國七十三年春作全省生產競賽中，最優農戶之公頃產量高達9.02公噸。再者，政府施以保價收購及每期作每公頃再補貼稻穀一公噸，因此推廣以來頗受農民歡迎。

然而，玉米屬旱田作物，一旦轉作於水田中，土壤之水分含量，通氣性，質地及結構等理化性質均異於旱田(1)。甚至田區四周生態環境變遷所引起的病蟲害防治，肥培管理等，理應有別於一般旱作管理。由本品種在民國七十二年春作之區域資料得知：臺南永康之試作區生育後期遭水患，植株早枯；雲林崙背地區因培土灌溉不當引起莖腐病，而臺中及桃園試作區則發生嚴重之螟蟲爲害(2)。再者，低窪地區之低產水田是否適合轉作玉米，換言之，此品種在生育期間忌水否等問題，均有待進一步的探討。本試驗乃探討玉米臺農351號在發芽及生育初期之耐水性，試驗中以臺南5號、臺南11號及臺南育6號玉米爲對照，以期研究不同土壤水分含量及播種後浸水日數對其生育之影響。試驗中所用之土壤取自本場水田之砂質壤土，該土壤之田間容水量(field capacity)爲38.1%，最大容水量(maximum holding capacity, MHC)爲46.5%。供試發芽及植株生育器皿爲容量200公升之橘色塑膠圓桶，直徑1.2公尺，高1.0公尺。

## 試驗一、土壤水分含量與發芽之關係

試驗期間每日利用Kett J-3型土壤水分計將各處理控制在，45.2%、58.9%、72.7%、86.2%及100.0% MHC，由圖一之土壤含水量與玉米發芽之關係可知，除最大容水量會抑制臺農351號玉米之發芽率外，45.2%~86.2% MHC之水分處理差異不明顯，然則對照之臺南5號、育6號及11號玉米在72.7% MHC之土壤狀態下發芽率較好，過濕時各品種發芽率低下。就幼苗生育而言(表一)，臺農351號玉米在58.9%~86.2% MHC土壤狀態下生育正常，當土壤水分含量在100% MHC時植株葉片黃化，葉綠素含量僅爲72.7% MHC處理區之71.4% MHC。至於其他3個對照品種之幼苗發育則以在58.9~72.7% MHC下生育較好，當土壤水分超過72.7% MHC時植株葉片已呈黃化。據此，臺農351號玉米似比臺南5號、育6號及11號等品種較具耐濕性。

## 試驗二、浸水對種子發芽之影響

本試驗將各品種玉米播種後處理0~5天之浸水，浸水深度爲土表1公分內完全淹水。各處理依浸水日數排水之，並於排水7天後測定其發芽率。由表二可知參試玉米品種經半日浸水均會影響發芽率，其中以臺南5號及育6號較嚴重，發芽率僅餘29.7%及39.4%，而臺農351號和

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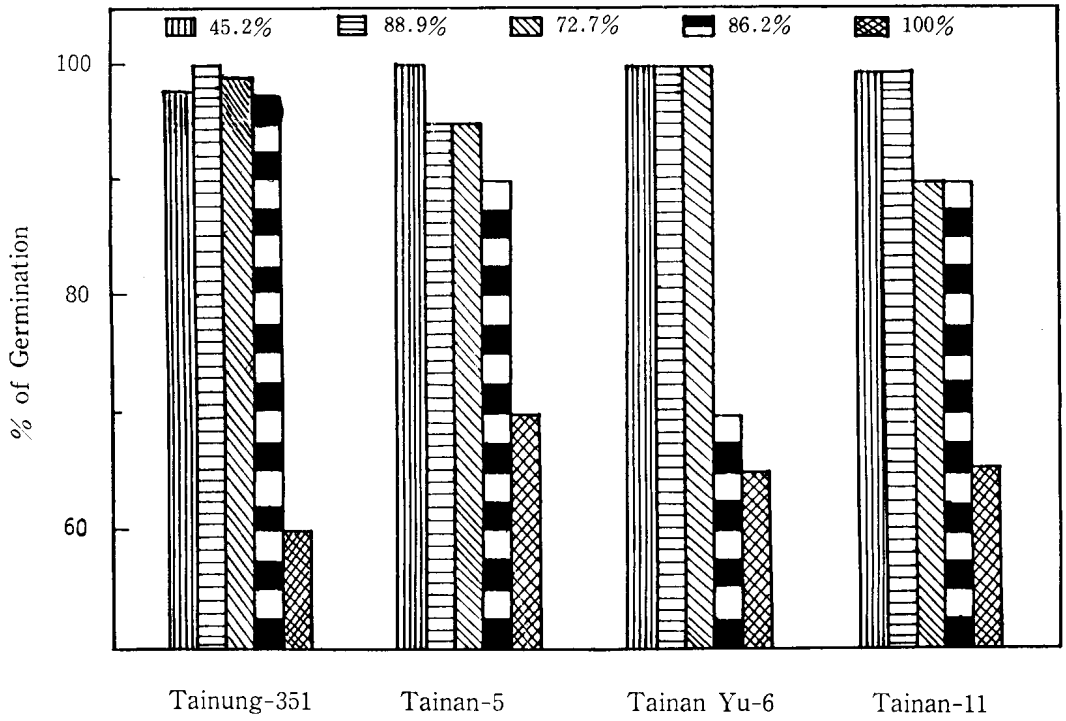



圖一、土壤含水量對玉米生育之影響。

Fig. 1. Effect of soil moisture on germination of corn Maximum holding capacity of soil (46.5% of dry soil basis) is an nidex of 100%

表一、土壤含水量對 7 天大玉米地上部生育之影響

Table 1. Effect of soil mositure on the shoot growth and chlorophyll conten of 7-day-old corn seedlings

| Soil mositure | Tainung-351 | | Tainan-5 | | Tainan yu-6 | | Tainan-11 | |
|---|---|---|---|---|---|---|---|---|
| (% MHC) | S | C | S | C | S | C | S | C |
| 45.2 | 40.0[b] | .360[a] | 45.0[c] | .359[b] | 48.5[c] | .341[c] | 30.0[d] | .304[b] |
| 58.9 | 49.2[a] | .369[a] | 63.2[a] | .391[a] | 50.0[c] | .377[b] | 45.0[c] | .314[b] |
| 72.7 | 52.6[a] | .374[a] | 64.7[a] | .389[a] | 69.2[a] | .401[a] | 55.0[a] | .371[a] |
| 86.2 | 52.0[a] | .377[a] | 58.8[a] | .377[b] | 65.0[b] | .403[a] | 51.1[b] | .329[b] |
| 100.0 | 33.3[c] | .267[c] | 43.3[c] | .317[c] | 31.3[d] | .311[d] | 42.9[c] | .329[b] |

Note: S: shoot dry weight (mg/plant).

C: chlorophyll content of corn leaf expressed in optical density by us k-1 chlorophyll neter.

Maximum holding capacity (MHC) of the tested soil was 46.5% of dry soil basis.

Means follwoed by same letter are statistically not significant at 5% level using Duncan's multiple range test.

臺南11號仍有65.7%；經浸水2日後，臺農351號仍保持45.0%之發芽率，而對照之臺南5號、育6號及11號則僅23.8%、28.1%及34.5%。因此，以本省豪雨季節之雨況而言，臺農351號玉米播種後田區泡水1~2日，仍能保持50%左右之發芽率。

表二、浸水對玉米發芽之影響

Table 2. Effect of flooding on the germination rate (%) of corn

| Flooding duration (days) | Tainug-351 | Tainan-5 | Tainan Yu-6 | Tainan-11 |
|---|---|---|---|---|
| 0 | 93.0[a] | 95.0[a] | 91.0[a] | 91.2[a] |
| ½ | 67.5[b] | 29.7[b] | 39.4[b] | 67.5[b] |
| 1 | 56.4[b] | 24.0[b] | 31.6[b] | 61.9[b] |
| 2 | 45.0[c] | 23.8[b] | 28.1[c] | 34.5[c] |
| 3 | 28.1[d] | 11.9[c] | 16.9[d] | 38.1[c] |
| 5 | 1.6[e] | 0[d] | 0[e] | 0[d] |

Note: Flooding treatments were Condncted ofter Sowing by immersing soil wire wcter for the indicated dnration, and reen drained odd water.

Measurement was made 7 days after drainning off water.

Means follwoed by same letter are statistically not significant at 5% level using Duncan's multiple range test.

**試驗三、$C_aO_2$對種子發芽之影響**

本試驗將參試玉米種子先以$C_aO_2$包護之，播種後再行2日之浸水處理，待排水後7日估算其發芽率微生物感染率及植株乾重，種子發芽過程微生物感染率的調查方法，係將種子挖出估算發霉數，由表三資料可知$C_aO_2$並不能促進玉米種子之發芽率及植株幼苗生育，種子包護與否無關於臺農351號、臺南5號及育6號之發芽及地上部生長，但會影響臺南11號玉米發芽率與生育。唯經浸水2日處理，種子若有$C_aO_2$包護則微生物感染較低，僅2.4%~11.6%間，反之則高達39.6%~59.6%。然就$C_aO_2$包護，雖能避免種子被微生物感染之機率，卻仍無法提高種子發芽之事實看來，浸水後玉米之不能發芽，似乎不是由於缺氧所致(4)。

表三、種子包護 $C_aO_2$ 對玉米發芽及幼苗生育之影響

Table 3. Effect of seed coating with $C_aO_2$ on germination and seedling growth of corn

| Treatments | Tainung-351 | | | Tainan-5 | | | Tainan Yu-6 | | | Tainan-11 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | G | S | I | G | S | I | G | S | I | G | S | I |
| With $C_aO_2$ | 45.8[a] | 71.3[a] | 7.4[b] | 23.4[a] | 81.8[a] | 2.3[b] | 29.3[a] | 71.9[b] | 3.1[b] | 34.6[b] | 67.4[b] | 11.6[b] |
| Control | 47.2[a] | 72.6[a] | 41.6[a] | 22.8[a] | 83.4[a] | 39.6[a] | 30.2[a] | 76.7[a] | 59.6[a] | 37.2[a] | 73.4[a] | 43.9[a] |

Note: Flooding was conduted after sowing by immersins soil with Water for 2 days then drained off water.

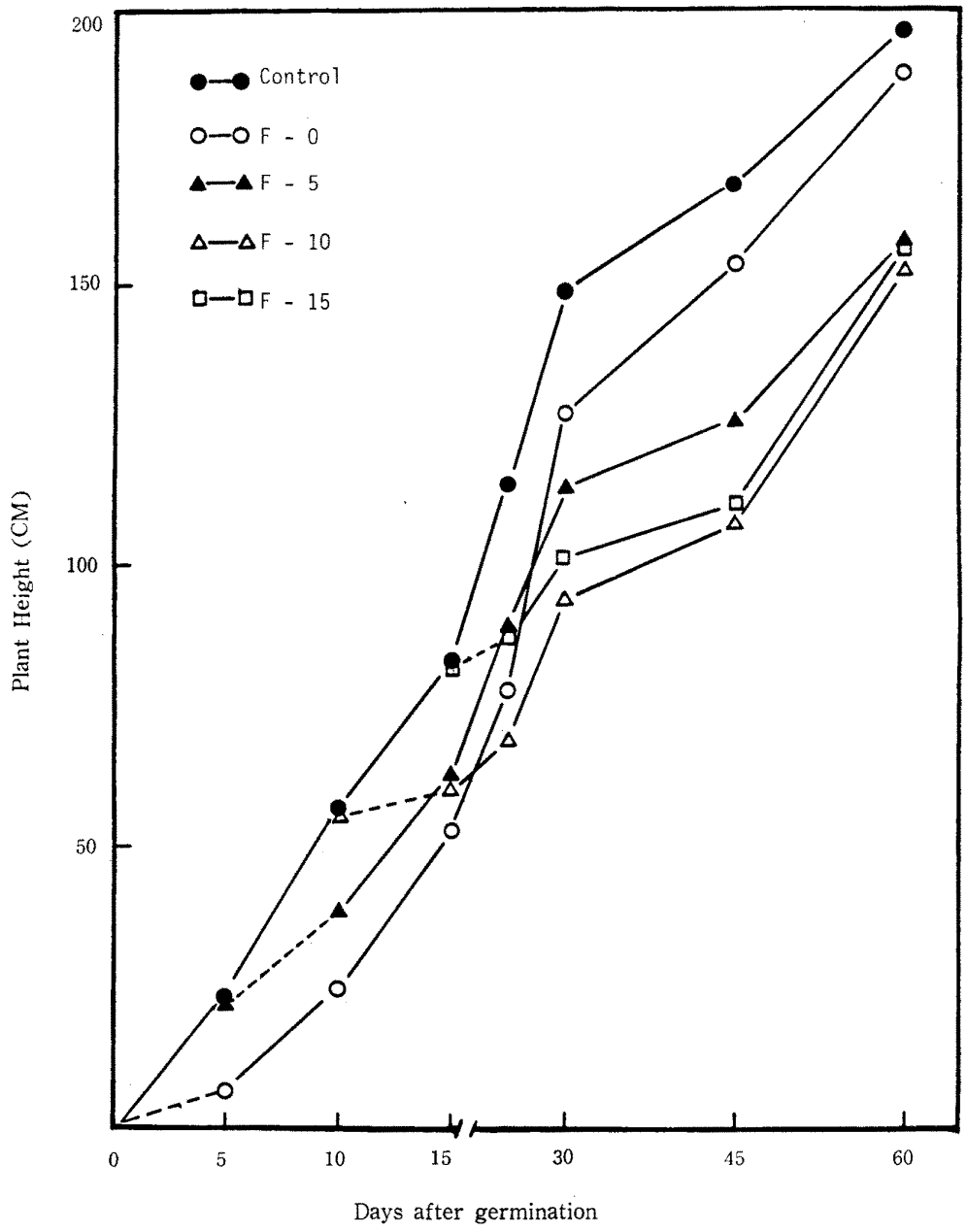
Measurements were nade 9 days after sowing.

Means followed by same letter was statisically not significant a 5% level using Duncan's multiple range test.

G: % of germination.

S: seedling dry weight (mg/plant).

I: % of microorganism infection.




圖二、不同生育期浸水 5 天對玉米臺農 351 號株高之影響。

Fig. 2. Plant height of flooded Tainung No. 351 corn Plants were immersed at different stages in a 5-day period and then drained off.

F-0: Flooding after germination.

F-5: Flooding at 5 days after germination.

F-10: Flooding at 10 days after germination.

F-15: Flooding at 15 days after germination.

**試驗四、浸水對幼苗生育之影響**

爲了解浸水對臺農351號玉米幼苗生育之影響，試驗中將發芽後之幼苗，每隔0、5、10及15天(F-0、F-5、F-10及F-15)分別浸水5天。試驗中塑膠桶中之水位控制在離地表30公分，而浸水5天處理後離水位亦爲30公分。由圖二之資料顯示發芽後15日內不論何時浸水，均會影響爾後之生育，導致植株矮化，各生育期中又以10天大之幼苗最忌浸水(F-10)，浸水3日後葉片出現黃化，下位葉之葉尖及葉緣發生萎凋(如圖三)，唯排水後半日即刻恢復。

基於以上之證據，臺農351號玉米確實比臺南5號、臺南育6號及臺南11號較耐水浸，在水田轉作玉米之推行上，將比其他品種較能忍受豪雨與高地下水位之影響。

圖三、浸水對發芽10天之玉米臺農351號幼苗之影響，下位葉發生黃化萎凋現象。
Fig. 3. Response of flooding on 10-day-old corn seedling. Yellow color and wilting symptom were found at lower leaves.

## 參考文獻

1. 水田轉作—田畑の高度利用— 1979 1-60頁，日本土壤肥料學會編，博友社出版。
2. 呂宗佳 1984 臺農351號玉米申請新品種命名資料 1-7頁，臺灣省農業試驗所編。
3. 彭作奎 1983 稻田轉作之時代背景，引至稻田轉作之政策及途徑。2-14頁，中華農學會主編。
4. Ota, Y. 1982. Promotion of emergence and establishment of rice seedlings by using calcium peroxide-coated seeds in direct sowing on flooded paddy fields. JARQ: 15(4):221-226.

# Influence of Soil Moisture on Germination and Growth of Corn (Zea Mays L. Var. Tainung No. 351)[1]

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## ABSTRACT

A new high yield corn variety, i.e., Tainung No. 351, is released recently which provided as a substitute for paddy rice. This preliminary study is aimed to evaluate the flooding resistant ability of Tainung No. 351. As compared to check varieties, Tainan No. 5, Tainan Yu-6 and Tainan No. 11, Tainung No. 351 could germinate well in a wide soil moisture range between 45.2% to 86.2% of maximum holding capacity (MHC) and checks only showed good germination at 72.7% MHC. Tainung No. 351 could also get 45.0% of higher germination rate than others after a 2-day flooding treatment. It was found that $C_aO_2$ seed-coating material could not improve the low germination tendency caused by flooding.

However, $C_aO_2$ coated seeds reduced microorganism infection by 41.3%. While different ages of seedlings were under a 5-day flooding treatment, 10 days old seedlings were more sensitive to flooding than other stages. Flooding treatment caused lower leaves to wilt and show yellow color. In conclusion Tainung No. 351 is more suitable for a substitute in paddy field than check varieties.

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