

Developing Sustainable Turfgrasses: Bermuda, Zoysia, and Seashore Paspalum

如何培育可持續的草坪草：狗牙根，結縷草及海濱雀稗

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Please note that Chinese subtitles are for reference only.

請注意：中文翻譯謹作參考用

Consistency

一致性

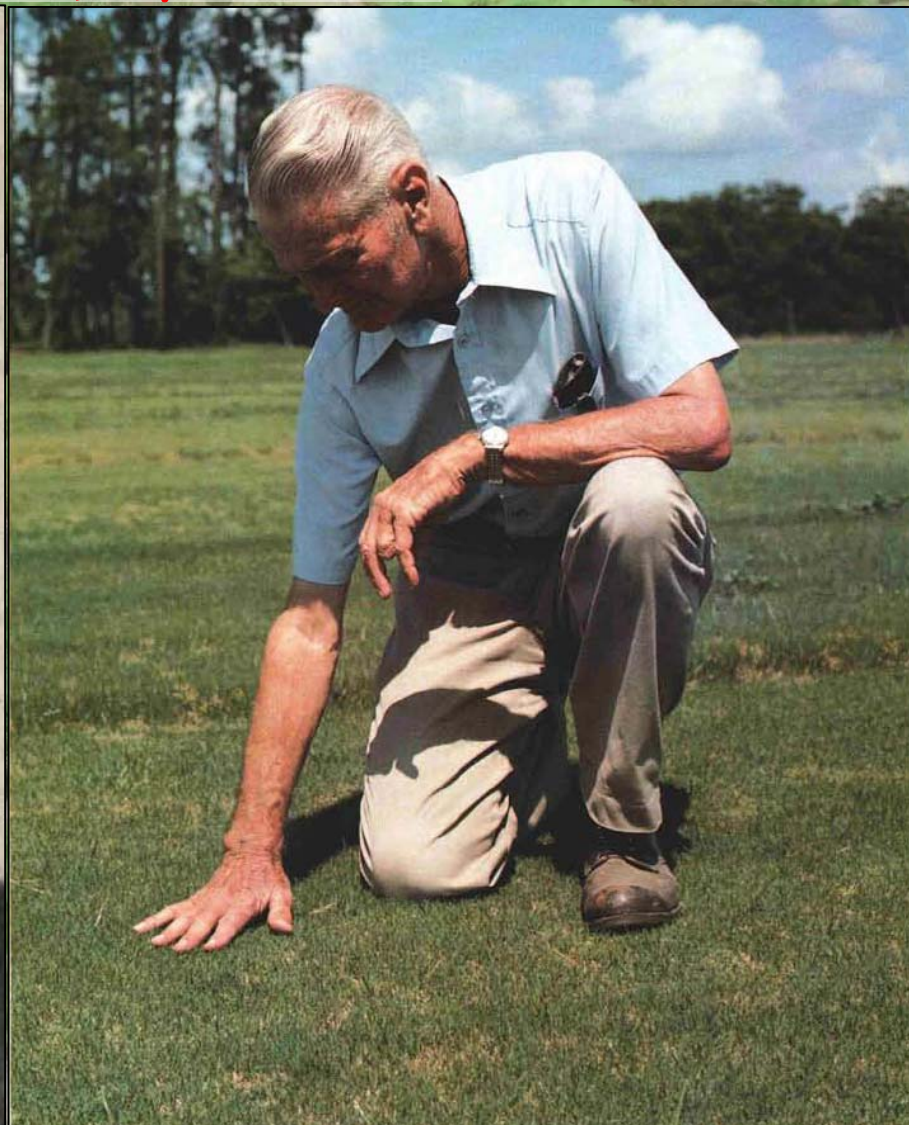
- 100 man years of plant breeding experience between Dr. Glenn Burton and Dr. Wayne Hanna

G Burton及W Hanna兩教授合共
100人/年的植物育種經驗

- **Dedication**
專業奉獻精神
- **Uninterrupted focus**
從不中斷的專注

Consistency

一致性



Consistency

一致性



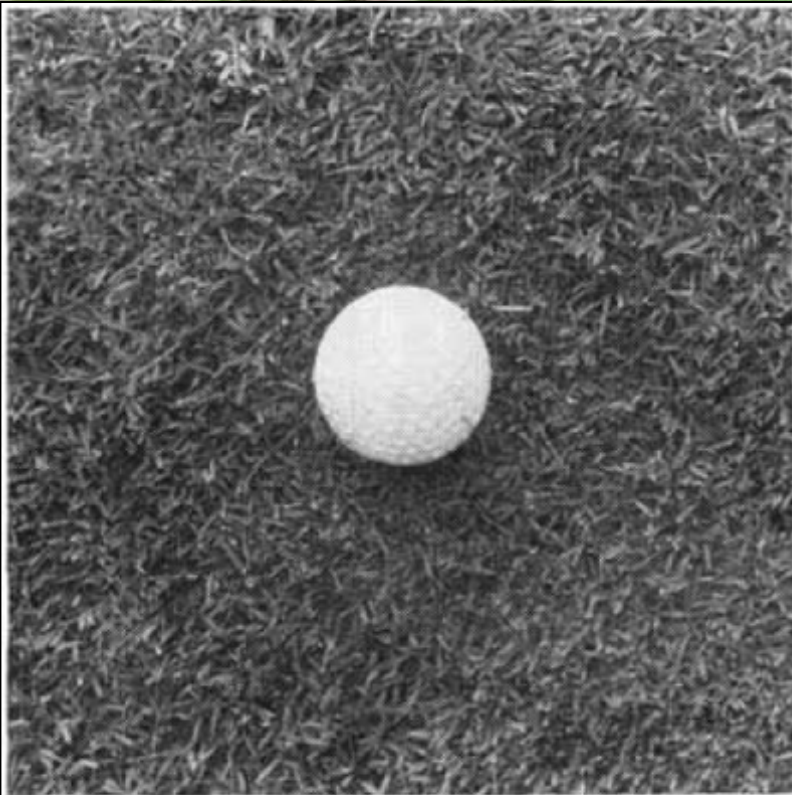
An aerial photograph of a golf course showing distinct patches of different grass types. The foreground and middle ground are covered in dense, green grass, likely the TifLawn or Tifton 57 varieties mentioned in the text. The background shows more varied terrain with some lighter-colored areas, possibly sand traps or different grass types.

TifLawn (1952)

Tifton 57

- Developed from forage breeding research
由牧草育種發展而來
- Darker green and finer leaf texture than common bermudagrass
比普通的百慕達草(狗牙根)葉色較深綠及葉片較幼細
- More disease and frost tolerant than common bermudagrass
比普通的百慕達草(狗牙根)的抗病及抗霜性更強
- Improved tetraploid (4x)
改良的四倍體(4X)

TifLawn (1952)



Tifton No. 57 Bermudagrass. Sod is dense and weed-free, has fine texture.



Bermudagrass from seed. Sod is coarse, with heads of Egyptian crabgrass.

An aerial photograph of a coastal landscape. The foreground and middle ground are filled with numerous small, rounded, green mounds of vegetation, likely moss or algae, growing on a rocky or sandy shore. The mounds are arranged in a somewhat regular pattern, separated by shallow, dark water or sand. In the background, the water transitions into a lighter green area, possibly a marsh or a different type of vegetation. The overall scene is a natural, somewhat surreal landscape.

“Mad” Science

“瘋狂”的科學

Chromosome Manipulation in Warm Season Turfgrass Species

暖季型草坪草品種內之染色體操控

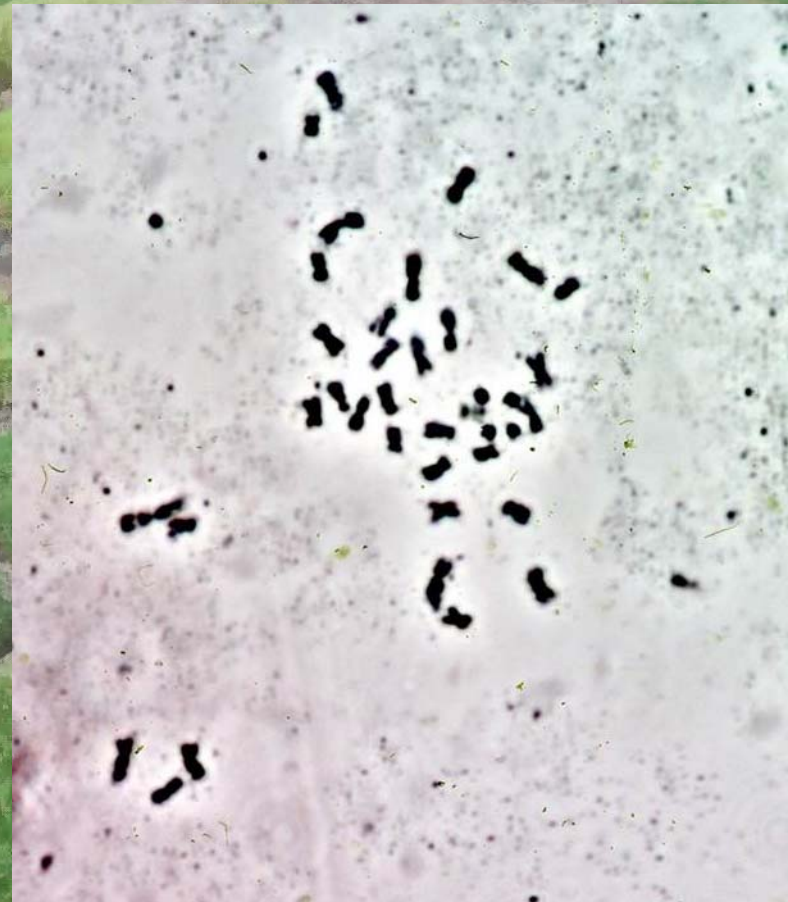
- **Increase Genetic Variation**
增加遺傳性的變異
- **Improve Vigor**
增加強壯性
- **Array of Phenotypic Variation in Crosses**
通過雜交產生一系列外表型的變異
- **Sterility - 不育性**
 - **Uniformity - 均一性**
 - **Genetic Purity for Sod Producers –**
可產生遺傳性純淨的草皮
 - **Energy NOT Used for Seed Development –**
無須因產生種子而浪費能量

“Hybrid” Triploid Bermuda

三倍體的“雜交”狗牙根



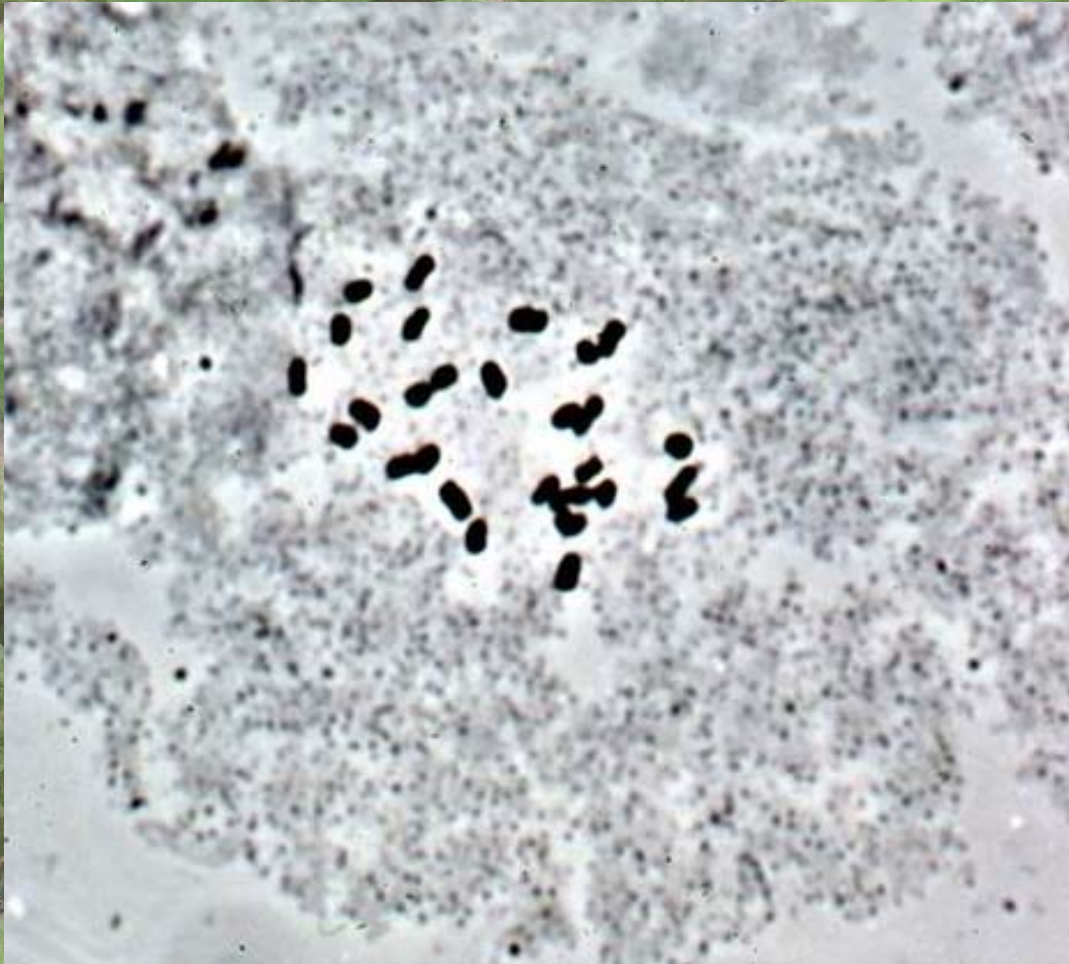
2x



4x

“Hybrid” Triploid Bermuda

三倍體的“雜交”狗牙根



3x

TifGreen (1956)

天堂328號

- Superior hybrid cross from fine textured common from 4th green on Charlotte Country Club x African bermudagrass

在Charlotte Country Club 第4果嶺上一細葉狗牙根和非洲狗牙根產生的優良雜交種

- Low growing and rapidly spreading

矮生及快速生長

- Soft, forest green leaves and fewer seedheads resulted in largest single step in putting quality (3/16" or ~0.190")

柔軟,翠綠色及較少花穗: 從而踏出了推桿質素(3/16英吋或~0.190英吋)的最大一步.

- Vastly improved triploid (3x)

大大改良的三倍體 (3X)

TifGreen (1956)

天堂328號



TifWay (1960)

天堂**419**號

- Superior chance interspecific hybrid cross from seed lot #2 sent from South Africa
與來自南非的編號#2的種子的優越機會雜交種
- Darker green color, greater frost tolerance, earlier spring growth, higher wear tolerance, and improved disease/insect resistance
較深綠色, 較高抗霜性, 較早春天生長(返青)及較佳病、蟲害抗性
- Major advancement for golf course fairways, tees, and athletic fields
為高爾夫球場球道、發球台、和體育場地用草最重要的進步
- Vastly improved triploid (3x)
大大改良的三倍體 (**3X**)

TifDwarf (1965)

矮脚虎(1965)

- Superior mutations from TifGreen at either #12 green at Florence Country Club, #2 green of the Plantation Course at Sea Island Golf Club, or the #6 green at Glen Arven Country Club
由TifGreen在 Florence Country Club第12果嶺、 Plantation Course at Sea Island Golf Club第2果嶺或Glen Arven Country Club第6果嶺產生之優良突變形成
- Small leaves and dense, uniform canopy resulted in superior putting quality at lower heights (5/32" or ~0.155")
幼細、密生和均一的葉片產生一優良及較低的推桿質素(5/32英吋或~0.155英吋)
- Darker green color than TifGreen with less N
較TifGreen更深綠及使用較少氮肥
- Significantly improved triploid (3x)
重大改良的三倍體 (3X)

TifDwarf (1965)

矮脚虎(1965)



TifDwarf (1965)

矮脚虎(1965)

*Tifdwarf—Bermudagrass
For Championship Greens*



Low handicappers like the fast, true roll of the ball when Tifdwarf greens are managed properly.

No New Cultivars (1965 - 1985)

沒有新的 栽培種(1965 - 1985)

- Problems on the horizon
面對的問題
- Instability of older cultivars
舊一代栽培種的不穩定性
- Mixtures and contamination as a result of lax inspection guidelines and regulation
由於寬鬆的檢驗準則和管制引至大量的混雜和污染
- Need for faster, more consistent greens
對更快及較一致性果嶺(推桿面)的需求

TifSport (1997)

體育草(1997)

- Derived from cobalt 60 gamma irradiated 'Midiron' rhizomes which were further tested in over 15 locations
由鈷**60gamma**射線輻射'**Midiron**'根莖而產生的變異種, 再經**15**地區重覆測試
- Cold resistant with high turf quality
高抗寒性及高草坪草質素
- Mow at ½" or lower
可低剪至½英吋或更低
- Only "Certified" triploid (3x) material is available for distribution

只有經"驗證"的三倍體**(3x)** 材料可供購買

TifSport (1997)

體育草(1997)



TifSport (1997)

體育草(1997)



TifEagle (1999)

老鷹草(1999)

- Derived from cobalt 60 gamma irradiated 'Tifway II' rhizomes which were further tested in over 35 locations

由鈷**60gamma**射線輻射'Tifway II'根莖而產生的變種，再經**35**地區重覆測試

- Uniform "ultradwarf" growth habit

統一性及“超矮生”的生長性

- Maintains green color and density even when mowed low (1/8" or ~0.125")

當低剪至**(1/8或~0.125英吋)**時仍可保持其顏色及密度

- Only "Certified" triploid (3x) material is available for distribution

只有經“驗証”的三倍體**(3x)** 材料可供購買

TifEagle (1999)

老鷹草(1999)



TifEagle (1999)

老鷹草(1999)



TifGrand (2009)

TifGrand (2009)

- Superior hybrid cross from (4x) by (2x) parents which has been tested for over 15 years
由(4x)和(2x)交配而產生的超級雜交種,再經15年的測試
- Tolerates 60% continuous shade
可容忍60%長期的遮蔭
- Tawny mole cricket resistance
對螻蛄有抗性
- Dark green color with leaf texture that is intermediate between TifSport and TifDwarf.
深綠色而其葉片的大小則是TifSport及TifDwarf之間
- Flexible response to mowing heights between 0.250" to 1.5"
剪草高度可靈活在0.250至1.5英吋間
- Only "Certified" triploid (3x) material is available for distribution
只有經“驗證”的三倍體(3x) 材料可供購買

TIF GRANDTM

CERTIFIED BERMUDA



TIF GRAND™

CERTIFIED BERMUDA



Hand Crosses

人工雜交



Hand Crosses

人工雜交



Crossing Blocks

雜交草塊



Unique Phenotypes

單一外表型



5265

Unique Phenotypes

單一外表型



Unique Phenotypes

單一外表型



Unique Phenotypes

單一外表型



Field Testing 實地測試



Hybrid Screening

雜(交)種甄別





Zoysiagrass

結縷草





Zoysiagrass

結縷草





Zoysiagrass

結縷草



Bermudagrass

百慕達草(狗牙根)



Hybrid Selection

雜交種的選取



Drought

乾旱



Photo courtesy of Dr. Gerald

Drought 乾旱

- Rain Exclusion Structures 防雨的結構



Drought 乾旱

- Root Depth Measurements 根深的量度



Drought 乾旱

- **LGIS (Linear Gradient Irrigation System)**
LGIS (線性漸層灌溉系統)

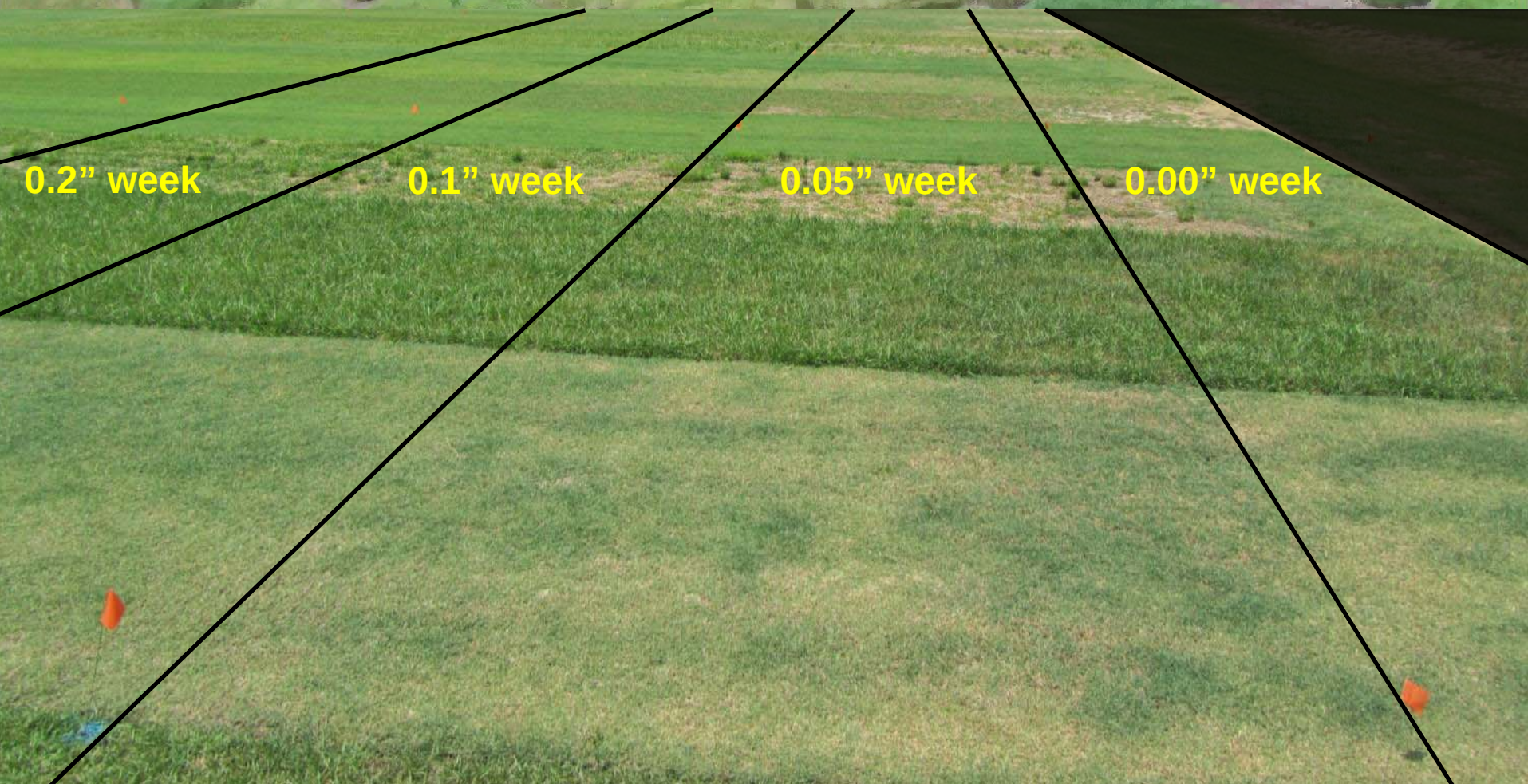


Drought

乾旱

- University Drought Trial during 2011 in Florida

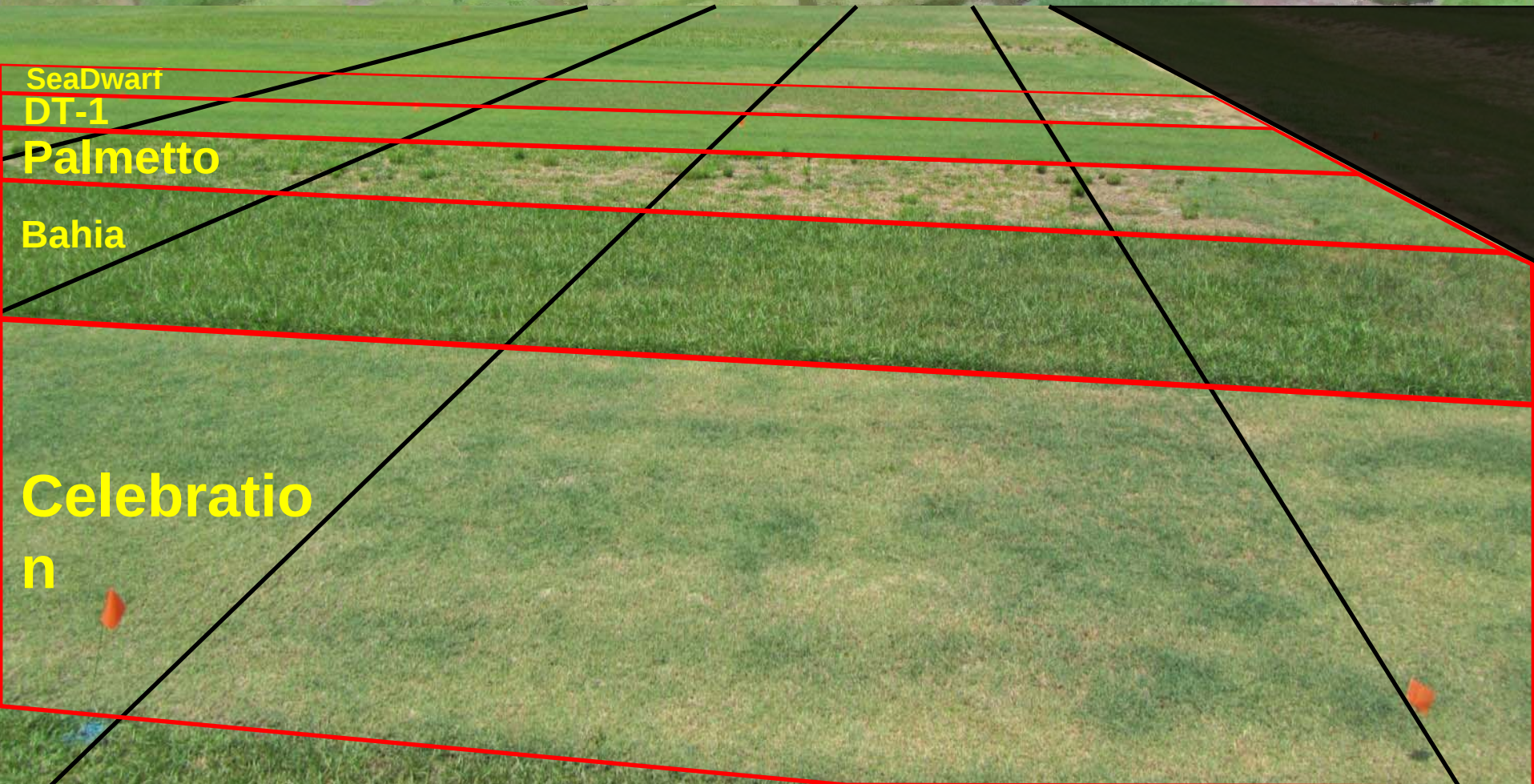
2011年大學在佛羅里達州舉行的乾旱實驗



Drought 乾旱

- University Drought Trial during 2011 in Florida

2011年大學在佛羅里達州舉行的乾旱實驗



SeaDwart
DT-1
Palmetto

Bahia

Celebratio
n

Drought 乾旱

- University Drought Trial during 2011 in Florida

2011年大學在佛羅里達州舉行的乾旱實驗

SeaDwarf

DT-1

Palmetto

Drought Trials

乾旱實驗



- Golf Course Trials during 2012 in Georgia
2012年在喬治亞州舉行的乾旱實驗

Drought Trials

乾旱實驗



- **Golf Course Trials during 2012 in Georgia**
2012年在喬治亞州高爾夫球場舉行的乾旱實驗

Drought/Shade Trials

乾旱/蔭蔽實驗



- Home Lawn Trials during 2012 in Georgia
2012年在喬治亞州家居草地舉行的實驗

Drought/Shade Trials

乾旱/蔭蔽實驗

- Home Lawn Trials during 2012 in Georgia

2012年在喬治亞州家居草地舉行的實驗

Drought/Shade Trials

乾旱/蔭蔽實驗

- Home Lawn Trials during 2012 in Georgia
2012年在喬治亞州家居草地舉行的實驗

Drought/Shade Trials

乾旱/蔭蔽實驗

- Home Lawn Trials during 2012 in Georgia

2012年喬治亞州家居草地舉行的實驗

Shade 遮蔽



- University Trials during 2012 in Georgia
2012年大學在喬治亞州舉行的實驗

Shade 遮蔽



- University Trials during 2012 in Georgia
2012年大學在喬治亞州舉行的實驗



- University Trials during 2013 in Georgia
2012年大學在喬治亞州舉行的實驗



Shade 遮蔽

- **Golf Course Trials during 2012 in Georgia**
2012年在喬治亞州高爾夫球場舉行的實驗

Wear Trials

磨損實驗



Wear Trials

磨損實驗



Wear Trials

磨損實驗



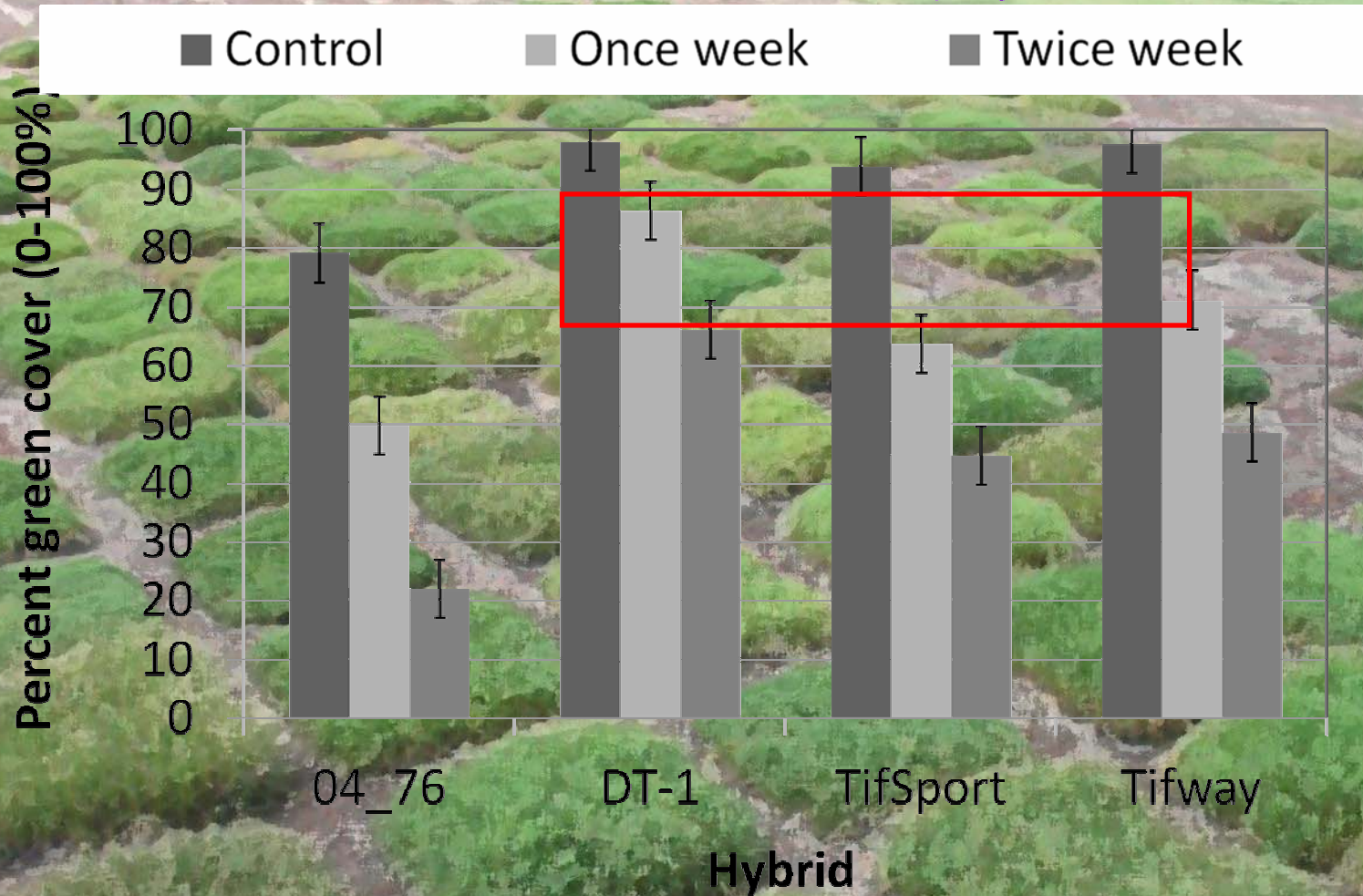
Wear Trials

磨損實驗



- University Trials during 2012 in Georgia
2012年大學在喬治亞州舉行的實驗

Traffic rate - 磨損率



Effects of bermudagrass hybrid by traffic rate on percent green cover observed after 6 weeks of traffic in Tifton, GA, 2012. Columns with overlapping error bars are not significantly different according to LSD (0.05).

Putting Green Trials

果嶺實驗

- University Trials during 2012 in Georgia

2011年大學在喬治亞州舉行的實驗

Putting Green Trials

果嶺實驗



- Golf Course Trials during 2012 in Georgia
2012年大學在喬治亞州舉行的實驗

Putting Green Trials

果嶺實驗

- Golf Course Trials during 2012 in Georgia
2012年大學在喬治亞州舉行的實驗

Putting Green Trials

果嶺實驗

- Golf Course Trials during 2012 in Georgia
2012年大學在喬治亞州舉行的實驗

Putting Green Trials

果嶺實驗



Putting Green Trials

果嶺實驗



Putting Green Trials

果嶺實驗





Champion Bermuda

07-4 Bermuda



Sod Farm Trials

草皮生產場實驗



Sod Farm Trials

草皮生產場實驗



A wide-angle photograph of a sod farm trial field. The field is divided into several long, narrow strips of different grass types, showing varying degrees of green and brown. In the background, there are trees and a clear sky. A semi-transparent white box with text is overlaid on the top right portion of the image.

Sod Farm Trials

草皮生產場實驗

Sod Farm Trials

草皮生產場實驗





Tifway

Tifton 419



DT-1

DT-1系

Cold Tolerance Trials

耐寒性實驗

- University Trials during 2012 in Indiana
2012年大學在印地安納州舉行的實驗

Cold Tolerance Trials

耐寒性實驗

- Farm Trials during 2012 in Illinois
2012年大學在伊利諾州舉行的實驗



Collaboration 合作

- **Turfgrass Management 草坪草之管理**
 - Worked in collaboration to study the effect of herbicides on turf establishment and seedhead suppression. Research the management and cultivar effects on golf, sport field, and home lawn performance.

合作研究除草劑對草坪建造和減少花穗形成的效用。管理和栽培品種對高爾夫、體育場地和家居草坪成效的研究。

Management

管理



Management 管理



Collaboration

合作夥伴





Questions???

問題???

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