# Selecting Kentucky bluegrass cultivars based on genetic analysis

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## Introduction

Recent publications on Kentucky bluegrass present classifications based on morphological characteristics and disease reactions and recommendations for blending options for each category of bluegrass cultivars. The purpose of blends of different types of bluegrass cultivars is to archive optimal performance. In order to meet this requirement, cultivars in the blend must have not only similar quality (appearance, leaf texture, and color), but also maximum genetic diversity among them in order to prevent from devastation by abiotic and biotic stresses. Maximizing genetic diversity of cultivars in blending is not an easy task with currently available information. Very limited numbers of morphological traits are utilized for the classification of Kentucky bluegrass cultivars. Also, the morphological traits used are very sensitive to the environment, meaning that the expression of traits is strongly influenced by the environment. Therefore, morphological traits based on narrow classifications can lead to improper selection of blends.

We performed a study of the genetic relationships among Kentucky bluegrass cultivars using a DNA marker type, RAPD (random amplified polymorphic DNA). The two main objectives of this work were to determine how much genetic variability (difference in DNA level) exists within Kentucky bluegrass cultivars and to compare the classification based on morphological traits to one based on genetic analysis.

## Materials and Methods

One hundred and twenty-three Kentucky bluegrass cultivars/PI collection were planted and grown under greenhouse conditions. For each cultivar, three separate plants were sampled and the DNA extracted. DNA was amplified using RAPD PCR and primers previously chosen for high numbers of polymorphic bands. Gel electrophoresis was performed using agarose gels and the resulting banding patterns were scored for polymorphic bands. Eighty-five polymorphic bands were scored across all samples. Computer based statistical analysis was performed and cultivars genetically classified. The genetic classification was compared with Rutgers's morphological classification of the cultivars.

## Results

Variability within cultivars ranged from below 0.05 to around 0.42 (Figure 1, Table 1). Preliminary results regarding comparison of morphological classification to genetic classification show that three morphological types, Compact-Midnight, Compact-America and BVMG, are grouped similarly according to genetic analysis.

## Conclusions

Preliminary results for comparing morphological and genetic groupings indicate that only three types are grouped similarly: Compact-Midnight, Compact-America and BVMG. When looking at the ancestry of these three groups we find that the cultivars in each group share a common parent in the breeding program. By sharing a common parent, they are more likely to inherit the same type of DNA from that parent.

Therefore when the progeny cultivars are genetically analyzed, they are found to be genetically related and therefore grouped the same way as the morphological groupings. Other cultivars in the morphological groupings did not share common parents and therefore when genetically analyzed, did not fall into similar groupings. This makes the morphological groupings unreliable when trying to choose cultivars to maximize genetic diversity in blends.

When looking at the genetic variability within a cultivar, we found a wide range in variabilities. This information is vital when choosing cultivars for a specific trait. A cultivar with low variability is more likely to be more homogeneous for a trait (meaning that more seeds are likely to express the wanted trait) than a cultivar with high variability. For example, if the two cultivars Arcadia (#4 in figure 1) and Midnight (#14) express a similar wanted trait, it would be better to choose Midnight because it has less variability and is more likely to express the wanted trait in all of its seeds.

In conclusion, our results suggest using morphological groupings that are also based on genetic groupings is advantageous when choosing cultivars for maximum genetic diversity and choosing cultivars with low variability is advantageous when trying to maintain a wanted trait.

In summary, our research indicates that selection of Kentucky bluegrass cultivars based solely on morphological groups does not guarantee maximum genetic diversity. The morphological groups must correspond to genetic groups. Success in selecting cultivars for a particular trait depends on the genetic variability of the cultivar. Therefore, knowledge of genetic characteristics is very important when selecting cultivars for Kentucky bluegrass blends.

Table 1: List of Kentucy bluegrass cultivars used in genetic analysis

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **1** | Crest | **32** | Rugby II | **63** | Blackstone | **94** | TXHb 333 |
| **2** | Adelphi | **33** | Alpine | **64** | Bluestar | **95** | TXHb 329 |
| **3** | Alene | **34** | America | **65** | Voyager | **96** | TXHb328 |
| **4** | Arcadia | **35** | Rita | **66** | Moonlight | **97** | Classic |
| **5** | Fairfax | **36** | Brilliant | **67** | Viva | **98** | Langara |
| **6** | Merit | **37** | Serene | **68** | Sodnet | **99** | Nugget |
| **7** | Nustar | **38** | Blacksburg | **69** | Livingston | **100** | Parade |
| **8** | Award | **39** | Freedom II | **70** | Kenblue | **101** | BlueChip |
| **9** | Quantum Leap | **40** | Odyssey | **71** | Cobolt | **102** | Chicago II |
| **10** | Cynthia | **41** | Washington | **72** | Chache | **103** | Famous |
| **11** | Rugby | **42** | PI371771 | **73** | Challenger | **104** | Nublue |
| **12** | Explorer | **43** | PI371775 | **74** | Denim | **105** | Absolute |
| **13** | SR2100 | **44** | PI372738 | **75** | Optigreen | **106** | Suffolk |
| **14** | Midnight | **45** | PI372742 | **76** | BA72-492 | **107** | Nassau |
| **15** | Geronimo | **46** | PI349225 | **77** | BA77-700 | **108** | Chatteau |
| **16** | Indigo | **47** | PI368233 | **78** | BA78-258 | **109** | Huntsville |
| **17** | SR2000 | **48** | PI368241 | **79** | BA74-017 | **110** | Baritone |
| **18** | Cannon | **49** | PI371768 | **80** | Bristol | **111** | Rhonde |
| **19** | Monopoly | **50** | Sweden Primo | **81** | Victa | **112** | Sebring |
| **20** | Gnome | **51** | Kazakhstan | **82** | BA87-102 | **113** | Baron |
| **21** | Limousine | **52** | US60-514 | **83** | Abbey | **114** | Ascot |
| **22** | Touchdown | **53** | US2020 | **84** | BA76-372 | **115** | Coventry |
| **23** | Park | **54** | Soviet Union | **85** | BA77-279 | **116** | Envicta |
| **24** | Glade | **55** | Russian Fed | **86** | BA79-260 | **117** | Buckingham |
| **25** | Ginger | **56** | US Belturf | **87** | BA73-626 | **118** | Goldrush |
| **26** | Banff | **57** | PI227381 Iran | **88** | BA74-114 | **119** | Boutique |
| **27** | Hungary | **58** | Turkey | **89** | BA70-242 | **120** | Bartitia |
| **28** | Denmark | **59** | PI380992 Iran132 | **90** | BA72-500 | **121** | Total Eclipse |
| **29** | Chicago | **60** | PI229721 Iran | **91** | BA73-540 | **122** | Bluemoon |
| **30** | Nuglade | **61** | Liberator | **92** | Unique | **123** | Barcelona |
| **31** | Award II | **62** | Northstar | **93** | TXHb 337 | | |

**Figure 1: Variability (mean of genetic difference among 3 sampels) within Kentucky bluegrass cultivars.**