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TURFGRASS TRENDS

EFFECTS OF ORGANICS

Organic and Biologically Amended Fertilizers

PART 2 Seasonal effects on turf quality and leaf chlorophyll content

By Adam Van Dyke

Superintendents manage large acres of turfgrass visible to the public and are often the targets of public scrutiny over the environmental impact of their management practices — specifically the use of synthetic fertilizers and pesticides. As the golf industry embraces the sustainable management movement, it seems like a plethora of commercial products containing organic and biological materials are being marketed to, and used by, superintendents.

Reasons for using these types of materials vary, but their use is nothing new (Carrier, 1923). However, the renewed interest in organic and biological products might be a way to reduce synthetic inputs on the golf course. The products also have uncharacterized benefits that may or may not improve turf health.

Research has shown that organic sources of nutrients can provide equally as good or better quality and growth of turf compared to synthetics (Rossi, 2006; Agnew, 1992), and biological inoculants have shown promise as bio-pesticides (Nelson et al., 1994). But studies in the field have lacked consistency (Nelson, 1998). Benefits associated with organic and biological materials often depend on application techniques (Jackson, 1999; Agnew, 1992) and environmental conditions (Rossi, 2006; Peacock and Daniel, 1995), creating uncertainty for end users. Therefore, the continued study of these types of materials under specific management regimes, and in different climatic regions, is important.

This study tested some commercially available organic and biologically amended fertilizers on golf course fairways in the Intermountain West for two years. The objective was to evaluate their effects on turf quality and leaf chlorophyll content when compared to some synthetic fertilizers.

The author would like to thank the superintendents at the courses — Troy VanDenBerghe at Willow Creek Country Club and David Willis at Glenwild Golf Club — for their assistance with this work.

Materials and methods

In Part 1 of this series, I explored assessing snow mold control with these specific

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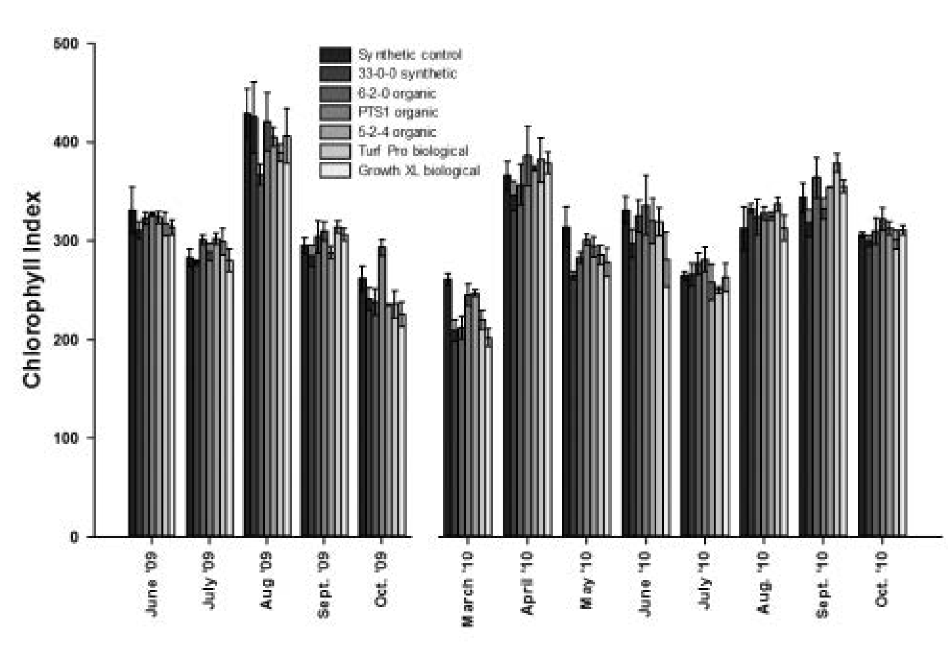
Editor's note: This is the second of a two-part series evaluating some organic and biologically amended fertilizers on actual golf courses. In September 2011's *Turfgrass Trends*, the author reported snow mold control data on highly maintained golf course turf after using these materials for two years compared to a PCNB fungicide.

IN THIS ISSUE

Effect of fertilizers on chlorophyll content of perennial ryegrass/creeping bentgrass fairway turf in 2009 and 2010. Error bars indicate standard deviation of the mean (n=3).

FIGURE 1: FERTILIZER IMPACT ON CHLOROPHYLL CONTENT



Continued from page 33

organic and biologically amended fertilizers on two golf courses. It also provided background information for the Willow Creek Country Club in Sandy, UT, used exclusively for this part of the experiment.

Three organic fertilizers and three biologically amended soil inoculants that contain nutrients were applied to a fairway for two years and evaluated against three synthetic fertilizers. The organic fertilizers consisted of Milorganite 6-2-0 classic (Milorganite, Milwaukee, WI), Sustane 5-2-4 (Sustane Natural Fertilizers, Cannon Falls, MN) and PTS1, an experimental material whose analysis and company are confidential. Biologically amended materials included Growth XL 16-4-8 (3 Tier Technologies, Orlando, FL), Turf Pro liquid 0.5-0.2-0, and Turf Pro dry 1.8-0-0.1 (Organic Products, Groveland, FL). The synthetic fertilizers were Andersons' 33-0-0 material (Andersons Golf Products, Maumee, OH), and Utah's Finest brand 23-3-16 and 20-4-20 materials (Great Basin Turf, Layton, UT). Programs for applying the organic and biologically amended fertilizers were based on manufacturers' recommendations to control snow mold. Synthetic fertilizers were applied at the same rate of nitrogen (N) to normalize the treatments, but differences in other nutrients occurred. Granular fertilizers were applied by hand, while liquid treatments were foliar applied with a pressurized backpack sprayer.

Turfgrass quality was assessed each month on a 1 to 9 visual scale, with 9 being best, 6 lowest acceptable, and 1 worst quality. Turfgrass color was also measured each month using a chlorophyll meter that estimated the chlorophyll content in the leaves on a 0 to 999 index scale, with higher numbers equaling darker green plots. Greenup was also evaluated each spring on a 1 to 9 visual scale, with 9 having the darkest green turf.

Turfgrass quality

All organic and biologically amended treatments provided acceptable turf quality from June to October in 2009, and most had acceptable quality from April to October in 2010. That was not statistically different from the synthetic control. Turf Pro-treated plots had significantly higher quality in April, 2010, while Growth XL- and PTS1 organic-treated plots had significantly lower quality in May 2010 compared to the synthetic control. Additionally, PTS1 organic-treated plots had significantly lower quality in August, 2010 due to poor uniformity from annual bluegrass (*Poa annua* L.) encroachment. It is unclear why this weedy grass appeared in these plots during the fall of the second year.

Chlorophyll content

The treatments did not influence turf color on most dates in this experiment (data not shown). However, PTS1 organic-treated plots appeared to have significantly darker green turf in October, 2009 compared to both synthetic-treated plots, while Growth XL-treated plots had significantly lighter green turf compared to the synthetic control (Figure 1).

This study tested some commercially available organic and biologically amended fertilizers on golf course fairways.

Additionally, Growth XL-, Turf Pro-, and some organic-treated plots had significantly lighter green turf compared to the synthetic control in March of 2010. However, Turf Pro-treated plots had significantly darker green turf compared to both synthetic-treated plots in September of 2010. Color differences measured in 2009 and early 2010 in Growth XL- and Turf Pro-treated plots may be explained by the reduced N inputs in the first year.

Conversely, color enhancements in Turf Pro-treated plots in the fall of 2010 cannot be explained considering the same reduced N inputs. A half-rate N treatment was not included in the study for comparison, and effects of Turf Pro in reduced N programs should be investigated further.

The synthetic control had significantly darker green turf compared to 6-2-0 organic-treated plots in the spring of 2010 and compared to PTS1 organic-treated plots in the spring of 2011.

Perhaps climatic differences in each winter influenced release characteristics of these organic fertilizers, explaining the inconsistent data in each year. The synthetic control also had significantly darker green turf in the spring of 2010 compared to Turf Pro and Growth XL biological-treated plots. This may be explained by reduced N applied in the late fall of 2009.

Conclusions

The organic and biologically amended fertilizers provided acceptable quality and similar color of fairway turf as some synthetic fertilizers for most of the two-year experiment. However, differences in form of N, release characteristics, amount and other ingredients contained in the products likely confounded the results, making direct comparisons difficult.

Despite the uncontrolled variables in this experiment, results support statements made by Ostermeyer (2003) that organics and biologicals can play a role in golf course management. Much more research is needed, however, to characterize their effects, identify specific uses and develop local strategies to best integrate these materials into golf course management programs geared toward reducing synthetic inputs.

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Alternative Products for Silvery-Thread Moss Control in Creeping Bentgrass

By Cole Thompson, Jack Fry and Megan Kennelly

Silvery-thread moss is a common weed in creeping bentgrass putting greens. Quicksilver (carfentrazone-ethyl) has been found to reduce silvery-thread moss populations and has become a standard for comparison for alternative moss control strategies.

Numerous studies have evaluated alternative products for silvery-thread moss suppression. Dishwashing detergent (Dawn Ultra, Ajax) and hydrated lime have been found to reduce moss populations; however, phytotoxicity of creeping bentgrass has been an issue. Several researchers have reported moss suppression with baking soda.

Settle et al. found that baking soda dissolved in water and applied with a hand-held trigger-spray bottle to wet moss colonies twice, two weeks apart in the spring, effectively controlled moss for the entire season. Kennelly et al. reported that spot treatment with baking soda at the same interval as Settle was as effective in moss suppression as Quicksilver. However, slight phytotoxicity to creeping bentgrass on the moss colony margins was observed for up to 14 days after treatment.

More research is needed into alternative products for silvery-thread moss control. Lower concentration spot treatments of baking soda and similar products may reduce moss populations while minimizing phytotoxicity to creeping bentgrass. It may also be possible to use baking soda in broadcast applications to reduce labor.

Alternative silvery-thread moss controls

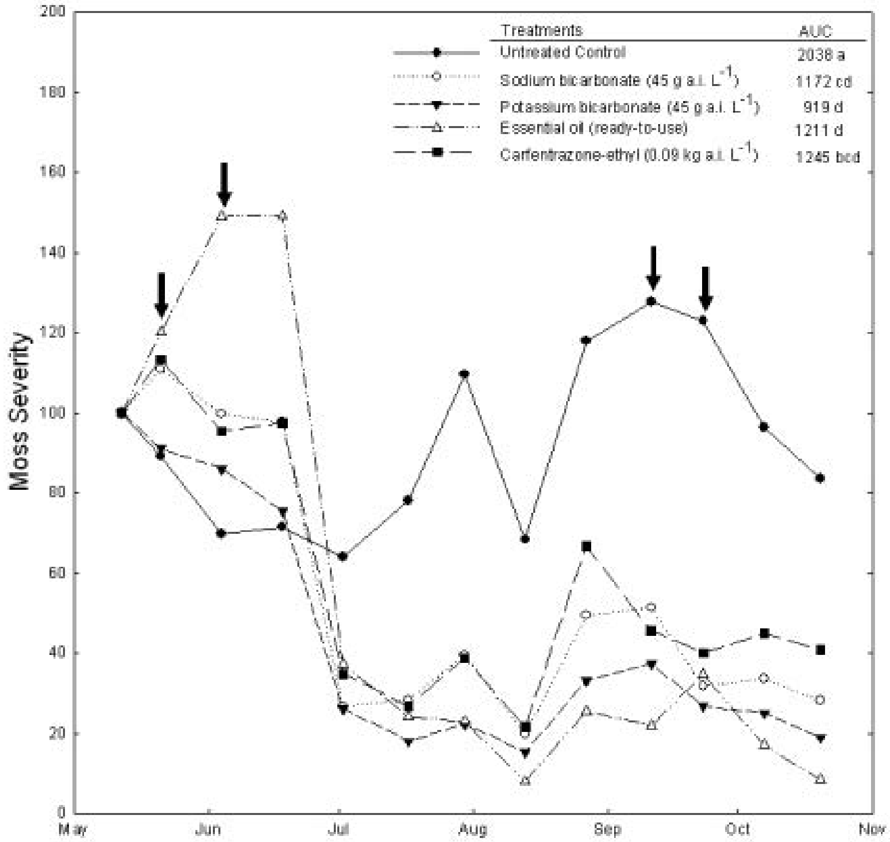
A field study was conducted in 2009 and 2010 at the Rocky Ford Turfgrass Research Center in Manhattan, Kan. Treatments consisted of an untreated control and eleven spot or broadcast applications: baking soda applied as a spot spray at 3 and 6 oz. gal^{-1} or as a broadcast at 18 and 36 oz. per 1,000 square feet; Armicarb (potassium bicarbonate), applied as spot-sprays at 3 or 6 oz. per gallon or as broadcast treatments at 1.8, 4.4, and 36 oz. per 1,000 square feet; Moss Buster [ready-to-use 1% essential origanum oil (i.e. oil of oregano)] was applied as a spot spray following label instructions; and Quicksilver broadcast at 0.14 oz. per 1,000 square feet.

Spot spray treatments were applied to individual colonies with a hand-held trigger-spray bottle until moss colonies were visibly wet. Broadcast sprays were applied using a hand-held CO_2 -powered sprayer. Baking soda (18 and 36 oz. per 1,000 square feet) and Armicarb (4.4 and 36 oz. per 1,000 square feet) were applied in a water carrier rate equal to 6 gallons per 1,000 square feet to increase the coverage and uniformity of applied treatment solutions, while Armicarb (1.8 oz. per 1,000 square feet) and Quicksilver (0.14 oz. per 1,000 square feet) were applied following label specifications at water carrier rates equal to 2.5 gallons per 1,000 square feet and 2 gallons per 1,000 square feet, respectively. All treatments were applied twice in the spring and fall of each year with two weeks between application dates.

Plots were rated every two weeks for percent moss coverage and creeping bentgrass color from May 12 to October 20, 2009; and from May 14 to October 13, 2010. Creeping bentgrass color data were also collected 1 and 7 days after treatment. Entire plots were rated for creeping bentgrass color using a 1 to 9 scale with 1 being totally brown, 6 minimum acceptable color, and 9 optimum green color. Percent moss coverage was rated visually by estimating the percent of each plot infested by silvery-thread moss.

Percent moss coverage differed among plots at the beginning of the study in each year. Thus, moss coverage was considered to be 100% at the time of the initial rating and moss severity for later rating dates was scaled accordingly. Area under the curve (AUC)

FIGURE 1: EFFECT OF TREATMENTS ON MOSS SEVERITY IN 2009



Treatments that reduced moss severity compared to untreated are displayed, and arrows signify application dates. Moss severity is a visual estimate of the percent of research plots infested with moss. Moss levels were significantly different on the first rating date. For this reason estimates for each plot were set to equal 100% on the first rating date. Means followed by the same letter are not significantly different (P < 0.05), according to Fisher's Protected LSD.

analysis was conducted on moss severity data to give a cumulative, season-long indication of moss severity.

Effect of treatments on silvery-thread moss severity

No treatment completely eliminated silvery-thread moss in either 2009 or 2010. According to AUC analysis in 2009, spot application with baking soda (6 oz. per gallon), Armicarb (6 oz. per gallon) or Moss Buster, as well as broadcast applications of Quicksilver, reduced moss severity 39% to 55% compared to untreated plots and were not statistically different from each other (Fig. 1).

Applying Quicksilver to moss temporarily turned it black; moss treated with baking soda, Armicarb or Moss Buster changed from green to reddish brown (Figs. 2-4).

With the exception of those treated with Armicarb, Moss Buster-treated plots had significantly lower moss severity than all other treatments on the final rating date in 2009 (October 20) and reduced moss severity to 8.4, from the starting point of 100 (Fig. 1).

Baking soda had significantly higher moss severity on this date than Moss Buster, and with a moss severity rating of 25.3, was still significantly lower than untreated. Conversely, baking soda and Armicarb (spot sprayed at 3 oz. per gallon); and broadcast applications of baking soda (18 and 36 oz. per 1,000 square feet), Armicarb (1.8, 4.4, and 36 oz. per 1,000 square feet), and Quicksilver were not significantly different from untreated plots, which had a moss severity value of 82.7, relative to the starting point of 100.

In 2010, no treatment reduced silvery-thread moss compared to untreated plots, according to AUC analysis (data not shown).

Influence on bentgrass color

Of the treatments effective in suppressing moss in 2009, Quicksilver was the only one that caused no visible phytotoxicity to creeping bentgrass in either 2009 or 2010 (Fig. 2).

Spot treatments of Moss Buster were most phytotoxic, resulting in color ratings below 4 within one day after application and requir-

Continued on page 38

FIGURE 2

Silvery-thread moss on 22 May 2009, one day after treatment with Quicksilver (0.14 oz. 1,000 ft^{-2}) on 21 May. Note the lack of creeping bentgrass phytotoxicity.

FIGURE 3

Silvery-thread moss and associated creeping bentgrass phytotoxicity on perimeters of moss colonies on 5 June 2009, one day after spot treatment with Armicarb (6 oz. gal^{-1}). Baking soda applications had similar effects on moss colonies.

FIGURE 4

Silvery-thread moss and associated creeping bentgrass phytotoxicity on perimeters of moss colonies on 22 May 2009, one day after spot treatment with Moss Buster.

PHOTOS COURTESY: COLE THOMPSON

Continued from page 37

ing up to 18 days to return to acceptable color (data not shown). In 2009, creeping bentgrass color in essential-oil treated plots was acceptable on 71% of rating dates, and in 2010 on 41.2% of rating dates.

Creeping bentgrass color after treating moss with spot applications of baking soda (6 oz. per gallon) was variable. In 2009, creeping bentgrass color was acceptable on 76% of rating dates. Recovery time following creeping bentgrass injury with baking soda ranged from 1 to 7 days. In 2010, no adverse effects of applying baking soda were observed. Phytotoxicity was observed after treating moss with Armicarb in 2009 and 2010, and creeping bentgrass color was acceptable on 82.4% in both years. Recovery time following creeping bentgrass injury associated with PB ranged from 1 to 8 days.

Spot treatment with baking soda or Armicarb at reduced concentrations (3 oz. per gallon) was not phytotoxic to creeping bentgrass, nor were broadcast treatments with baking soda (18 oz. per 1,000 square feet) or Armicarb at lower rates (1.8 or 4.4 oz. per 1,000 square feet).

Conclusions

Two spring and two fall applications with spot treatments of baking soda (6 oz. per gallon), Armicarb (6 oz. per gallon), or Moss Buster, as well as broadcast applications of Quicksilver, were shown to reduce moss severity in the first year of this two-year study.

Spot treatments of bicarbonate-based products and Moss Buster have the potential to serve as alternatives for moss control and can suppress moss colonies at a level similar to Quicksilver. However, turf phytotoxicity can occur when using baking soda or Armicarb, and severe phytotoxicity is possible when using Moss Buster.

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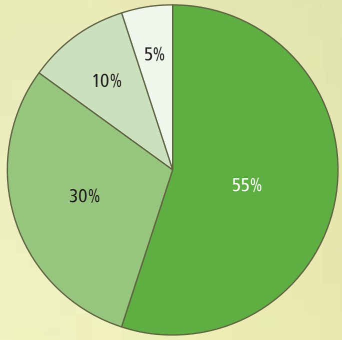

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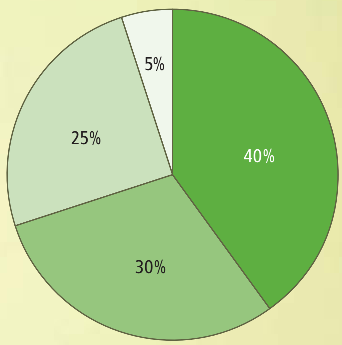

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David Hay, CGCS

Indian Wells CC, Indian Wells, Calif.

I'll have a Coors Light. That's what I started out with in my underage drinking days in high school. I've stuck with it.

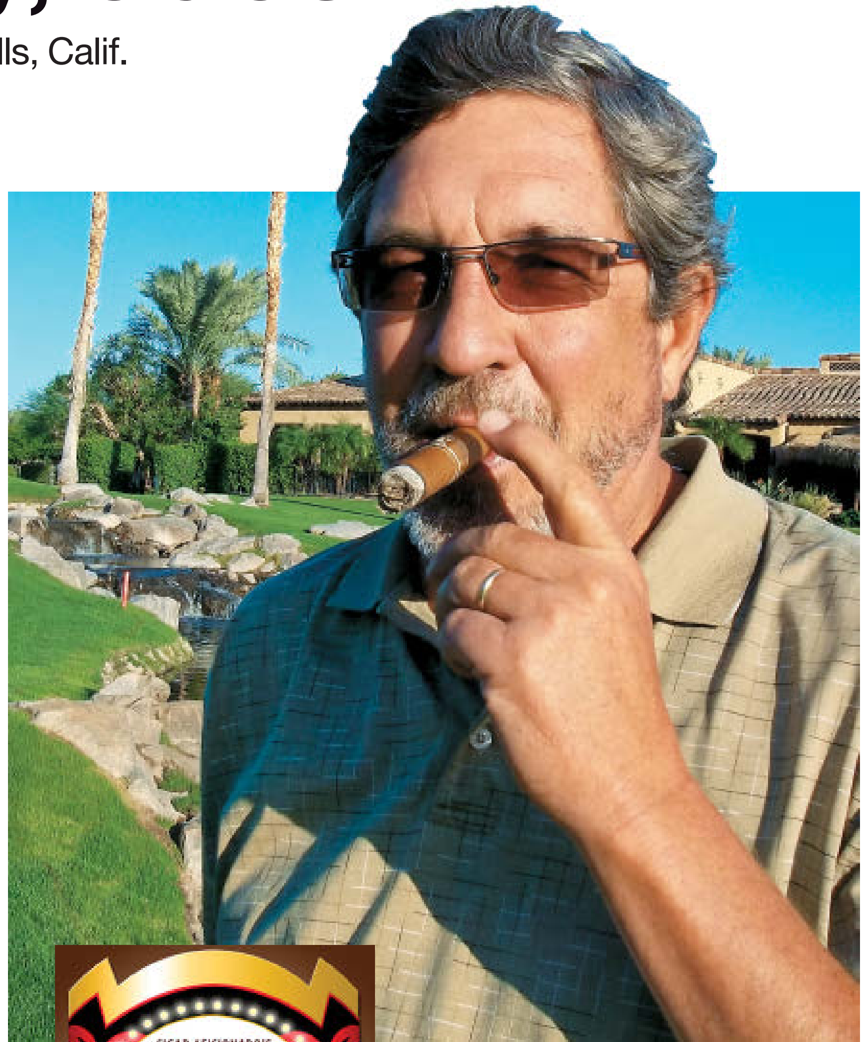
I've been smoking cigars for 12 years. Every year I try to go to the "Big Smoke" event in Las Vegas. It's a fun event, lots of cigar smokers, and cigar smokers are all pretty decent people. You get to try a lot of different cigars. It's a blast. One is in Vegas, one is in New York. There are like 4,000 people, from all over. You run into people, you create friendships. It's almost like going to the National.

You want a suggestion for a good cigar? Well, how much money ya got?

I was in the Air Force for five years. It was great. It gave me a chance to grow up. I was 18 years old when I went in. What are you going to be at 18? It gave me an education in something I would have never had a chance to do otherwise. And grow up, learn some responsibilities and develop discipline.

I'm a Broncos fan. I'll tell you why people like Tim Tebow: He's a true football player. He's a decent guy and a true football player. He got a lot of scrutiny because of his faith and he's not scared to tell people.

The Bob Hope? They don't call it the Hope anymore. It's the Humana Challenge in conjunction with the Bill Clinton Foundation. There's no mention of Bob Hope at all anymore.



CIGAR AFICIONADO'S BIG SMOKE Las Vegas

U.S. AIR FORCE

The coolest celebrity I ever met when we hosted the Hope was Samuel L. Jackson. I brought my son Jason to the tournament, he was 15 at the time, and Samuel is sitting there in a golf cart. Jason just walked up to him and said hi. They ended up chatting for 30 minutes. Alice Cooper is a close second. Alice saw Jason at the Kraft Nabisco and he said, "Hey, I remember you, your dad is the superintendent at Indian Wells!!"

As interviewed by Seth Jones, January 15th, 2012

MAIN PHOTO BY: CURT HARLER; TEBOW PHOTO COURTESY: THE DENVER BRONCOS FOOTBALL CLUB