ALTERNATIVE SPIKE RESEARCH 2000: TRACTION AND LONG TERM WEAR

T.A. Nikolai, J.N. Rogers III, and K.W. Frank

Alternative Spike Traction Research

On 17 July 2000 an alternative spike traction study was conducted at the Forest Akers Driving Range at Michigan State University. Thirty six volunteers capable of wearing size 11 golf shoes took part in the testing. While signing in to participate the volunteers were asked to NOT look at the soles of the shoes while lacing them on. Afterwards the participants began an obstacle course by lacing on a pair of golf shoes and proceeding to the driving range tee to hit golf balls. After hitting several golf balls they were asked to rate the traction of the pair of shoes they were wearing on a scale of 1 to 5. The traction scale was 5 = excellent, 4 = very good, 3 = good, 2 = fair, and 1 = poor traction. Next, the participants proceeded to hit several golf balls on a slope and from a sand bunker and assign a traction rating using the same scale. After hitting golf balls from each of the three stations the volunteers repeated the course wearing a different pair of Foot-Joy Dry Joys with a different set of alternative spikes inserted into them. One pair of golf shoes had no alternative spikes inserted and was regarded as a check.

Traction from the Driving Range Tee

Traction data from the driving range tee are presented in Figure 1. The 8 mm metal spike received the highest percentage of excellent ratings. However, through statistical analysis of ordinal data, all treatments followed by the same letter in parenthesis are considered statistically equivalent. Statistical analysis revealed the Spider Bite, Black Traction, and Black Widow provided the same amount of traction as the 8 mm spike. At the other end of the traction scale was the check pair of shoes with 43% of the participants rating the traction as poor and another 39% rating them as fair. Of the alternative spikes, the Tred-Lite treatment received the fewest amount of excellent and the greatest percentage of poor and fair ratings from the driving range tee.

Traction from a Slope

Data regarding traction during the golf swing from a slope are presented in Figure 2. Once again the 8mm metal spike received the highest percentage of excellent ratings with Spider Bite and Black Widow giving the same amount of traction as the 8 mm metal spike. The flat sole check treatment was regarded as least acceptable traction with 68% of the participants giving them a rating of poor. Of the alternative spikes, the Tred-Lite treatment received the greatest amount of poor and fair ratings but statistically provided the same amount of traction as six other alternative spike treatments.

Traction from a Bunker

Data regarding traction while hitting golf balls from a sand bunker are given in Figure 3. In striking a ball from a sand bunker Black Widow received the highest percentage of excellent ratings with Spider Bite, 8 mm metal, Scorpion, and Eclipse statistically equivalent to the Black Widow. Once again the flat sole check treatment was regarded has having the worst traction. The Tred-Lite, Extra Performance, Shadow, and GreenKeepers had the poorest traction from the bunker of any of the alternative spike treatments.

Long Term Wear Study

On 10 June 2000 a long term wear study (six weeks) was initiated on a USGA putting green at the Hancock Turfgrass Research Center. Prior to initiation, traffic pattern observations were made throughout the United States and Norway. The purpose of these observations were to collect data on golf course putting greens that would allow for practical amounts of traffic to be applied on research plots on a daily basis.

The dilemma regarding long term wear studies has been how much traffic to apply on a daily basis. Past traffic studies at other Universities have resulted in putting surfaces being deteriorated to the point of bare soil. Applying traffic to this extent is unrealistic and serves little, if any, practical purpose. The quandary for research is that golf courses move the cup daily to minimize traffic while research plots must be confined to a given area for the purpose of collecting data as well as space and time constraints. MSU's traffic observations are an attempt to make the traffic research plots as realistic as possible by changing the amount of wear each plot receives on a daily basis.

The long term wear study was a randomized complete block design with three replications. The same 12 treatments that were in the traction study plus a non-trafficked check plot were used in the study. Each plot was partitioned into two distinct areas that received different amounts of traffic six days of the week (unless rain events postponed trafficking). Each plot consisted of an inner traffic area measuring 2'3" x 2'3"centered within an outer traffic area that measured 3'7" x 3'7". Traffic was applied to these two areas consistent with the field observations that were averaged from the aforementioned multiple sites in the United States and Norway. Wear tolerance ratings were taken on a scale from 1 to 5 with 1 = poor wear tolerance and 5 = excellent wear tolerance.

Wear ratings obtained on the six days that heavy traffic was applied are presented in Table 1. The heavy traffic treatment represents the amount of footsteps that occur in the vicinity of the cup on a day that 200 rounds of golf are played. The 8 mm metal spike received the lowest rating on all six dates. On 12 July, all plots performed satisfactorily with the 8 mm metal spike receiving the lowest ranking and only Diamond Back, Scorpion, and Black Traction not receiving wear ratings statistically equivalent to the non-trafficked check plot.

On 18 July, Scorpion, Spider Bite, and Eclipse shared the statistically lowest rankings with the 8 mm spike. By 27 July, the third day of heavy traffic, the 8 mm metal spike and Spider Bite displayed the most visible damage to the plots. On 3 August, the 8 mm spike received a rating of 1 meaning all three replications of the study received a ranking equivalent to poor wear tolerance.

On 14 August, wear tolerance improved for most treatments from the previous weeks rating. This most likely occurred because the plots were sand topdressed and received 0.5 lbs. N per 1000 sq. ft. on 4 August. On 14 August, the 8mm metal spike and the Spider Bite received the lowest wear tolerance ratings. On 21 August, the 8 mm metal spike received the lowest possible rating with all other treatments receiving acceptable ratings.

On 25 August, soil cores were taken from each plot to determine the impact of the traffic on each of the plots. Data are reported in Table 2. Though the treatments were statistically different in their effects on several factors, the practical significance of the results is negligible due to the high variability observed. The Hydraulic conductivity for the Tred-Lite treatment borders on non-acceptable for USGA specifications, however, statistically speaking there was no difference between the Tred-Lite treatment and the check plot. Similar results were seen for bulk density and the total porosity values. The moisture retention at 0.04 bars is considered the soil water that is available to the plant. Once again the Tred-Lite treatment resulted in the lowest numerical value, but only the check plots, spikeless flat sole shoe, and Eclipse resulted in statistically greater moisture retention and the numerical values were of minor importance.

Conclusions

The Black Widow and the Spider Bite were the only alternative spikes that matched the traction of the 8 mm metal spike on all three areas while striking a golf ball. With respect to turfgrass wear ratings, the metal spike received the numerically lowest rating on all dates. However, on three of those six dates there was no statistical difference between the Spider Bite and the 8 mm metal spike. The Black Widow never averaged a wear rating below 3 (a numerical value equivalent to good turf quality).

Acknowledgements

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Table 1. Turfgrass wear tolerance ratings for the heavy traffic treatment.

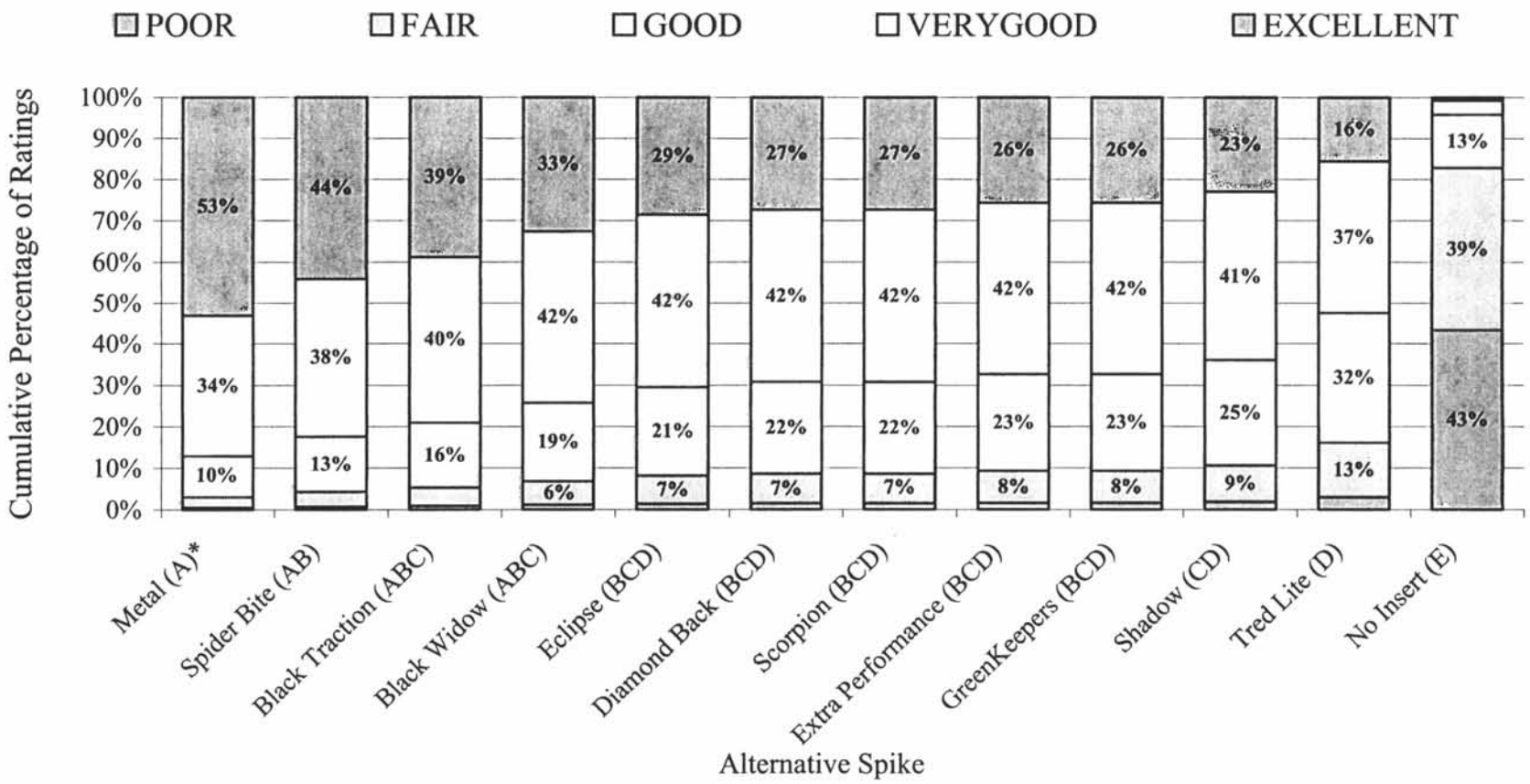
Alternative spike	Date					
	12-Jul	**18-Jul**	**27-Jul**	**03-Aug**	**14-Aug**	**21-Aug**
Black Widow	4.7 ab	4.3 abc	3.0 cde	3.3 bcd	3.3 cd	3.7 bc
Eclipse	4.7 ab	3.3 cde	3.7 bc	3.3 bcd	4.7 ab	4.3 abc
Shadow	5.0 a	4.7 ab	3.7 bc	4.0 ab	4.7 ab	5.0 a
Spider Bite	4.7 ab	3.0 de	2.3 ef	2.3 d	2.3 ef	3.3 cd
Diamond Back	3.7 cd	3.7 bcd	3.7 bc	2.3 d	4.0 bc	4.0 abc
Scorpion	4.0 bc	3.0 de	2.7 de	2.7 cd	3.0 de	4.7 d
Black Traction	4.0 bc	3.7 bcd	3.7 bc	2.7 cd	3.3 cd	4.0 abc
Green Keepers	5.0 a	4.0 abcd	4.0 b	3.7 bc	4.7 ab	5.0 a
8 mm Metal	3.0 d	2.3 e	1.7 f	1.0 e	2.0 f	1.0 e
Spikless flat sole	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a
Extra Performance	4.7 ab	4.7 ab	4.0 b	3.3 bcd	4.7 ab	4.7 ab
Tred-Lite	4.7 ab	4.0 abcd	3.3 bcd	3.0 bcd	4.0 bc	5.0 a
Check	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a
LSD @ 0.05	0.9	1.2	0.96	1.1	0.7	1

Table 2. Soil Physical Properties from Alternative Spike Research

	Hydraulic conductivity	**Bulk Density**	**Moisture retention at 0.04 bar**	**Total Porosity**	**Capillary Porosity**	**Air-filled Porosity**
Black Widow	24.3 cde	1.61 abc	12.9 cd	39.3 cde	20.7	18.6
Eclipse	36.8 a	1.56 de	15.2 ab	41.1 ab	23.6	17.5
Shadow	22.4 de	1.62 ab	13.6 bcd	39.0 de	22.0	17.0
Spider Bite	29.6 abcd	1.57 cde	13.5 bcd	40.8 abc	21.2	19.6
Diamond Back	36.1 ab	1.56 cde	13.4 bcd	41.1 ab	20.9	20.2
Scorpion	22.9 de	1.60 abcd	13.9 bcd	39.4 bcde	22.4	17.0
Black Traction	22.8 de	1.62 a	13.8 bcd	38.7 e	22.4	16.3
Green Keepers	23.3 cde	1.62 a	12.8 cd	38.8 e	20.8	18.0
8mm Metal	29.5 abcd	1.58 bcde	13.4 bcd	40.6 abcd	21.0	19.6
Spikeless flat sole	34.6 abc	1.56 e	14.4 abc	41.2 a	22.3	18.9
Extra Performance	31.8 abcd	1.59 abcde	13.3 bcd	39.9 abcde	21.1	18.8
Tred Lite	16.1 e	1.63 a	12.4 d	38.7 e	20.2	18.5
Check	25.4 bcde	1.59 abcde	16.1 a	40.1 abcde	25.6	14.5
LSD	11.3	0.04	1.97	1.71	3.19	4.17
Probability	*	**	*	**	NS	NS

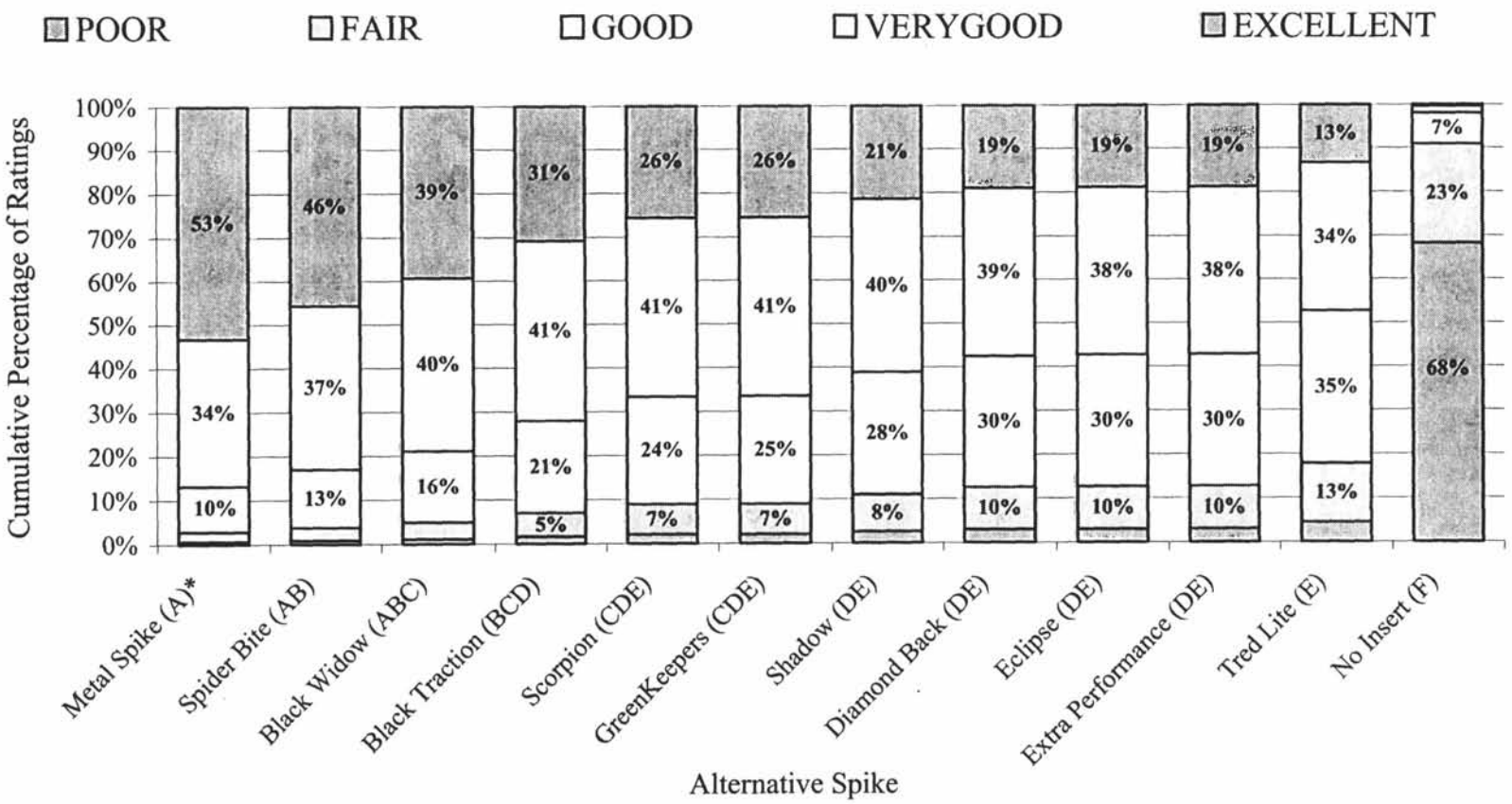
*, **, and NS denote significance at the 0.05, 0.10 probability level, and not significant, respectively.

Figure 1. Alternative Spike Traction from the Driving Range Tee



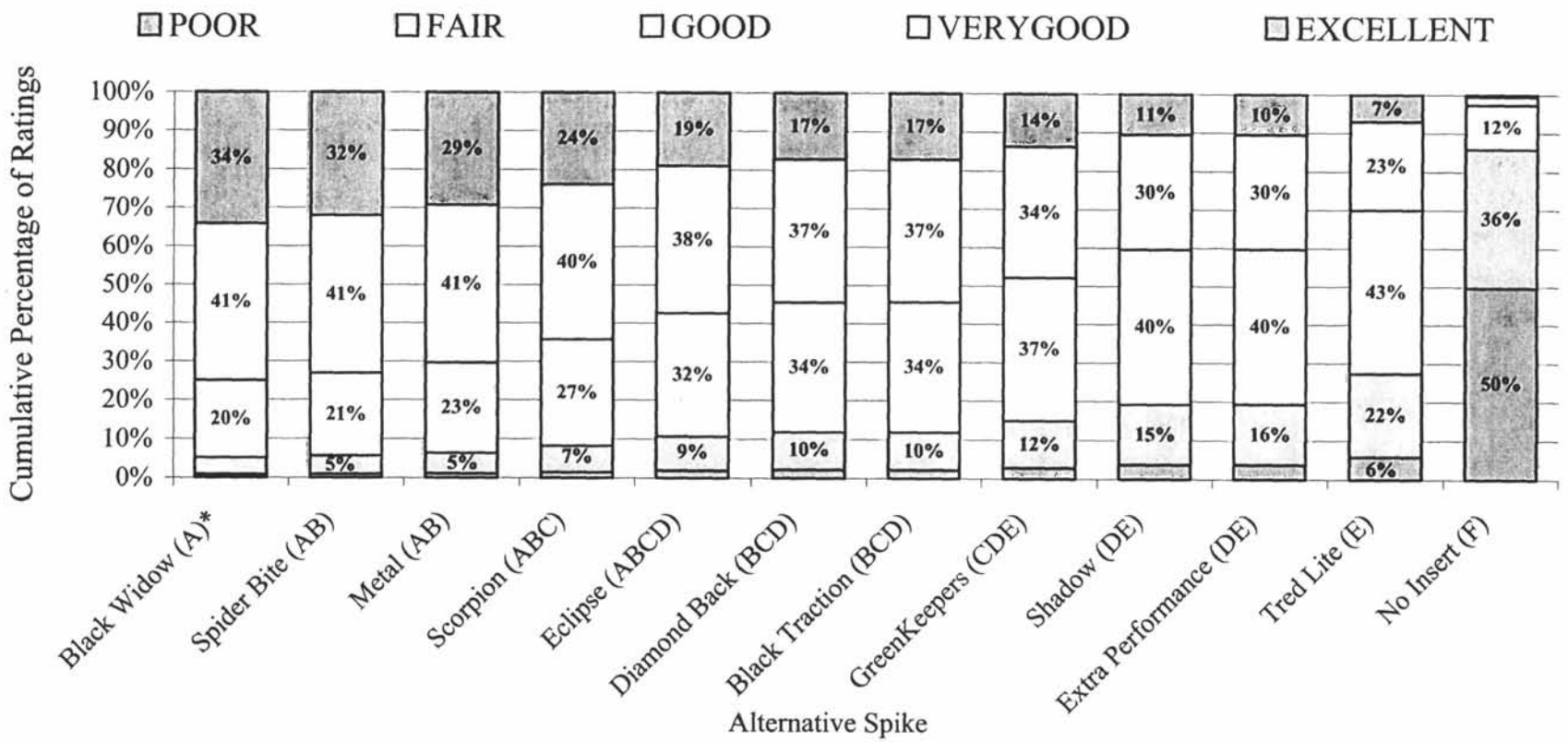
*Bars sharing a letter are not significantly different (P = 0.05).

Figure 2. Alternative Spike Traction from a Slope



*Bars sharing a letter are not significantly different (P = 0.05).

Figure 3. Alternative Spike Traction from a Bunker



*Bars sharing a letter are not significantly different ($P < 0.05$).