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Scientist Analyzes Baseball

Do Managers Need Degree?

By WILLIAM HOYT

Scientists, being human, like a baseball game as well as the next fellow, but one Arizona scientist at least, watches the national sport with more attention than most.

He is Dr. J. E. McDonald of the University of Arizona's Institute of Atmospheric Physics, and his scientific analysis of baseball was the highlight of last November's Arizona Academy of Science annual meeting in Tucson.

McDonald, who talks about as fast as Bob Feller used to pitch (141 feet per second), described his highly technical investigations in the annual academy address, delivered Saturday morning to some 220 persons, including a dozen or so Junior Academy members who presumably spend more time on the diamond than does Dr. McDonald.

His findings, delivered in fine scientific jargon, would have confounded old Casey Stengel almost as much as Casey's pronouncements confuse everybody else. But Dr. Cuz might do well to study them.

The idea, McDonald explained, is for the batter to hit the ball at an angle of 35 degrees from the ground with sufficient force (3000 pounds) to give it an average velocity of 125 feet per second. To achieve this velocity, he added, the hitter should swing the bat so that the bat at the moment of impact with the ball, is traveling a trajectory at a rate of 128 feet per second. This will give him optimum range.

However, this, McDonald explained, is not easy to do as the ball, coming from the pitcher's mound, is also moving at an average speed of some 125 feet per second, and is spinning at a rate of 1,500 revolutions per minute, again on the average.

Feller's aforementioned speed thus introduces a scientific reason for his prowess as a pitcher. Most batters, McDonald noted, don't get the bat going 144 feet per second. To find out how fast they do swing he tested Woody Heisk and Willie Kirkland of the Cleveland Indians, who hold spring training in Tucson, and also tried out a few of UA roach Frank Sansel's better boys as subjects for his micro-photographic photographs and calculations.

Heid showed up fairly slow at the beginning of spring training, swinging only at a 90-foot-per-second clip. A month later, Heid had wound up after a month's training with a 130-foot-per-second swing, McDonald said.

The fastest man with a bat clocked during his experiments, McDonald added, was Wilford slugger Bill Brown, who brings that bat around at a 135-foot-per-second clip.

One statistic calculated by McDonald but not to be found in any of the regular baseball record books is the fact that the average pitcher, at the moment he lets go of the ball, has developed the "fantastic" acceleration force of 2,540 feet per second per second (speed increases 2,540 feet per second EVERY second). This figure McDonald translated into "G's" or gravities which is perhaps familiar enough in this modern space age. An acceleration of 79 G's, incidentally, is more than enough to make jelly out of an astronaut.

But it's not only how you play baseball, but where and when you play it, McDonald continued.

"Temperature, humidity, pressure, altitude, winds and the length of time the ball has been stored before use all play a role to varying degrees.

A direct effect on the distance of a "standard hit" of 25 degrees in elevation traveling an average of 175 feet per second. A 50 degree temperature change adds or subtracts 15 feet in distance.

A pressure change of 100 millibars can lengthen a hit by 35 feet, and an increase of altitude of, say, 5,000 feet, will add 24 feet to a "standard" hit. Air density is another factor managers should check as a 10 per cent cut in density, for instance, adds 17 feet to the average batter's range.

Humidity has much to do with the mass of the ball itself, and mass, of course, effects distance. Dr. McDonald showed descriptive charts for wool and cotton, which make up most of the wrapping of baseballs, which indicate that moisture absorbed during storage would have a lot to do with deadening the ball, and detracting from its liveliness.

"I would suggest that the leading baseball manufacturers wrap their balls in a penny's worth of plastic to eliminate this," McDonald suggested slyly.

McDonald noted that the effect of sudden humidity changes also cuts down on the bounciness, and that this surprised him that he mentioned it to his brother-in-law, a non-scientific baseball fan.

"I told him that a change from zero to 100 per cent humidity would result in a decrease in the distance of a standard hit of about three feet," Dr. McDonald recalled.

"He told me," Dr. McDonald added, "that a change in humidity from zero to 100 percent would result in the cutting of the game."

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