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Effectiveness of Heat Detection Patches for Determining Cyclicity Status in Peripubertal Heifers

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Introduction

Response to most estrous synchronization programs is improved in cycling females, compared to pre-pubertal heifers or anestrus cows. Cycling status is often monitored for research purposes by measuring progesterone concentrations in serum. Producers may want to use information on cyclicity status when determining which estrous synchronization program to use or as a component of their heifer selection.

Heat detection patches are routinely used to aid or reduce time needed for heat detection. The most data on their use is for a 3 to 5-day period after estrous synchronization. Little information is available on retention of patches for longer time periods or how they may compare with serum progesterone for determining cyclicity status. Therefore, the objective of the current study was to compare Standing Heat and Estrotect heat detection patches with serum concentrations of progesterone for identifying cycling (pubertal) heifers before the start of the breeding season.

Experimental Procedures

Heat detection patches were applied to 104 yearling Angus and Angus-Hereford crossbred heifers 30 days prior to fixed timed AI (21 days before receiving a CIDR insert). Heifers received both an Estrotect patch and a Standing Heat patch with the order of which patch was closest to the head (most cranial) alternating for every other heifer. Patches were scored by degree of color change at 3, 10, and 21 days after being applied. Patches were scored as 0 = unchanged, 1 = color change on less than half of the surface, 2 = color change on more than half of the surface, 3 = slicked clean and 4 = patch missing. Serum samples were collected for determination of progesterone concentration on days 10 and 21 after patch application. Heifers with progesterone concentrations ≥ 1 ng/ml in at least one of the two samples were considered to be cycling.

Results and Discussion

All patches were still in place 3 days after application. When Standing Heat patches were used the previous year, retention was a problem (See the article on page 3 of this report "Comparing Standing Heat and Estrotect Heat Detection Patches"). Since that time, the product underwent some manufacturing changes and the retention to day 3 during the current study indicated an improvement had been achieved. However, in the process of applying the Standing Heat patches, sometimes the patch could not be removed from the backing paper without some of the backing paper remaining adhered to the patch. These patches were not used. Edges of Standing Heat patches had some degree of curling for 67 patches (Figure 1B), compared to 4 Estrotect patches on day 14, and 44 compared to 15 patches on day 21, respectively. In some cases, the edge curling of the Standing Heat patch prevented all the color from being removed (Figure 1A). Another issue experienced with the Standing Heat patches was separation of the color layer from the adhesive layer, and sometimes the color layer was totally gone (Figures 1B and 1C).

On day 3, 7 heifers (6 cycling) had a patch score of 3 for both Standing Heat and Estrotect patches and 94 heifers scored 0 for both patches. By day 10, 15 Estrotect (5 cycling) and 16 Standing Heat (5 cycling) patches were missing. One animal missing an Estrotect patch had a corresponding Standing Heat score of 3, whereas two animals with missing Standing Heat patches had Estrotect scores of 0 and 1. For 74 of 104 (71.2%) heifers, the patch scores were the same on day 10. By day 21, 53 and 42% of Standing Heat and Estrotect patches, respectively, were missing. Both patch types experienced a similar number of missing patches that were placed closest to the head (most cranial) by day 21, whereas 30 Standing Heat patches were lost in the caudal location (closest to tail) compared to 18 for Estrotect patches. On day 21, patch scores were the same for 68 of 104 heifers (65.4%; Table 1). Of animals missing patches on day 21, 18 patches were from animals classified as non-cycling for both patch types. Therefore, 41% of missing Estrotect patches and 33% of missing Standing Heat Patches were from non-cycling or pre-pubertal heifers. These data indicate that current estrus detection patch retention rate for a 21-day interval may not be adequate to identify cycling status of females before the beginning of the breeding season.

The predictive ability for Estrotect or Standing Heat patches to accurately predict cyclicity compared to progesterone samples are reported in Table 2. For Estrotect patches, sensitivity (true positive, P4 ≥ 1 ng/ml) was 79% and specificity (true negative, P4 < 1 ng/ml) was 30%. With 74 of 104 heifers displaying positive signs of estrus, the positive predictive value (probability a heifer with a score of 2, 3 or 4 had cycled) was 91% (95% Confidence Interval, 83-96.4). The negative predictive value (probability a heifer with no color change had not cycled) was 13% (95% Confidence Interval, 2.8-33.6). Standing Heat patches were comparable to Estrotect in sensitivity but were low in specificity (8.3%) and had a negative predictive value (4.4%).

Patch scores were best at indicating a heifer was likely to have elevated progesterone concentrations, but were not a good indicator that the animal would have low progesterone (non-cycling). Because behavioral estrus and ovulation are known to occur independently, particularly during periods of transition, such as for these peripuberal heifers, expectations for better specificity and sensitivity were perhaps unrealistic. Patch scores were comparable between the two types of patches however Standing Heat patches had additional challenges with application and more issues with the edges of the patches curling.

Table 1. Cross tabulation of scores from each patch type

	Standing heat score day 21					
Estrotect score day 21	**0**	**1**	**2**	**3**	**4**	Row sum
0	2	1				3
1	4		2	1		7
2		3	1		2	6
3		1	5	25	13	44
4		1	1	2	40	44
Column sum	6	6	9	28	55	104

Shaded areas represent general agreement (light grey; activated 2, 3, or 4; unactivated 0, 1) to complete agreement (dark grey).

Table 2. Cycling status of peripubertal heifers as determined by serum progesterone and Estrotect or Standing Heat estrus detection patches on day 21

	Cycling (score[a] 2, 3, or 4)	Non-cycling (score[a] 0 or 1)
Estrotect patch status		
P4 ≥ 1 ng/ml -Test positive, number	74 (true positive)	7 (false positive)
P4 < 1 ng/ml Test negative, number	20 (false negative)	3 (true negative)
Sensitivity (95% CI)*	78.7 (70.4-87.0)	
Specificity (95% CI)*		30 (1.6-58.4)
Standing Heat patch status		
P4 ≥ 1 ng/ml -Test positive, number	70 (true positive)	11 (false positive)
P4 < 1 ng/ml Test negative, number	22 (false negative)	1 (true negative)
Sensitivity (95% CI)*	76.1 (66-84.4)	
Specificity (95% CI)*		8.3 (0.002-38.5)

[a]Patches were scored as 0 = unchanged, 1 = color change on less than half of the surface, 2 = color change on more than half of the surface, 3 = slicked clean and 4 = patch missing.
*CI = Confidence Interval.

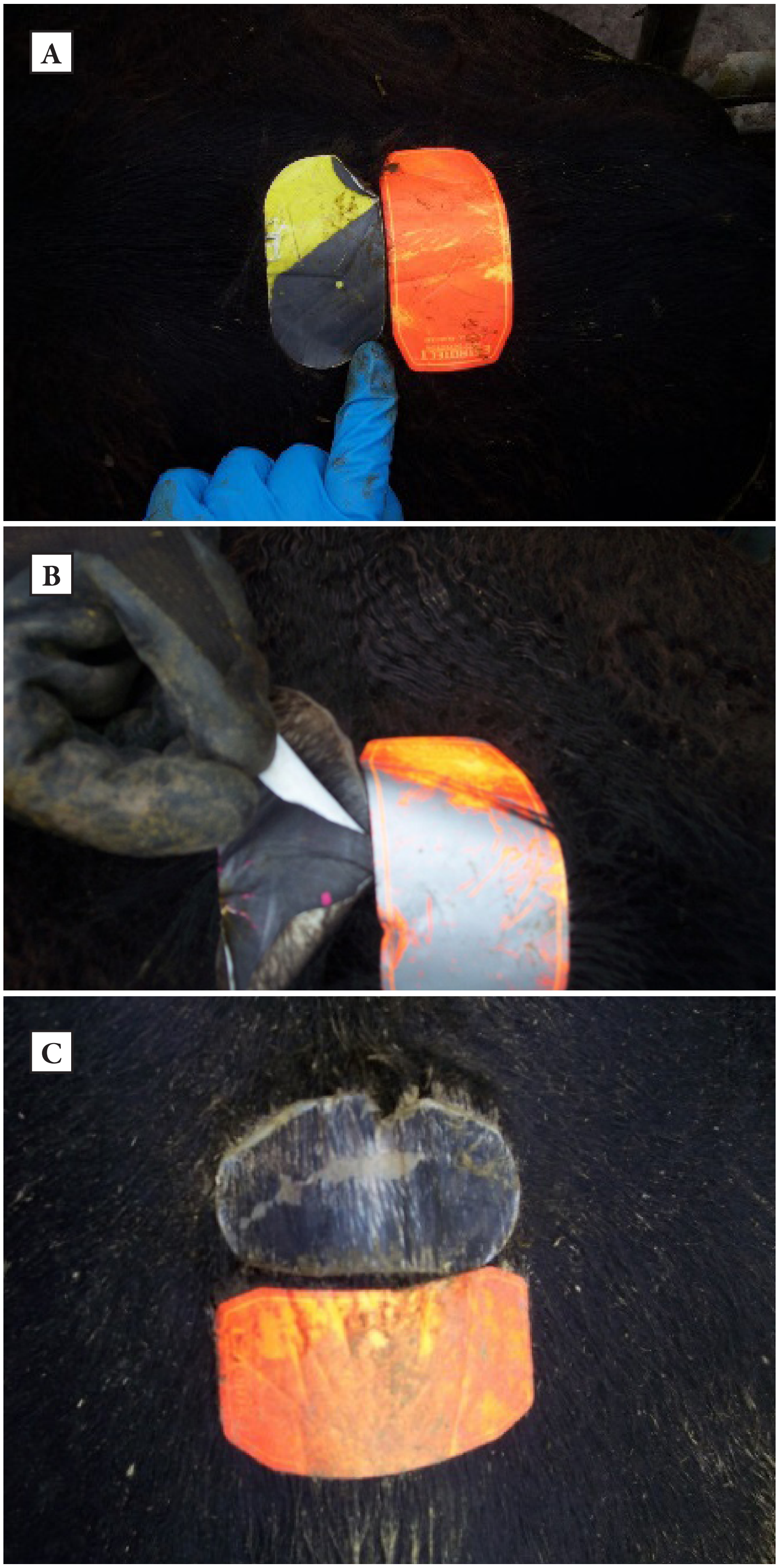

Figure 1. Examples of patch changes over time.
A) Yellow Standing Heat patch edge came loose and patch folded over onto itself preventing full color removal, exposed portion scored, orange Estrotect patch with full color change; B) example of color layer separating from adhesive layer in Standing Heat patch on the left; C) color layer completely removed from Standing Heat patch, top; Estrotect patch, bottom, is fully activated.