

# 臺灣黃牛產後助孕素之分泌與其繁殖特性<sup>(1)</sup>

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收件日期：107 年 6 月 25 日；接受日期：108 年 3 月 7 日

## 摘 要

為瞭解產後期間繁殖性狀與助孕素分泌情形，本調查針對 13 頭 3 – 8 歲臺灣黃牛母牛採血進行測定，並利用血漿中助孕素濃度監控卵巢活動與懷孕狀態。試驗期間，除仔牛可自由吮乳外，配戴下巴標記球 (chin-ball marker) 的種公牛亦與母牛同群放牧。從母牛產後至受孕之天數與懷孕率顯示，本土黃牛能達到一年一胎的產犢間隔胎距，同時具備良好的繁殖能力。臺灣黃牛母牛產後第一次發情有 30.8% 為 7 – 10 天的短週期發情，大部分母牛的產後初次發情之前均無相關的卵巢活動，但 78% 的排卵與行為性的發情有關係，且 83% 的母牛在產後初次排卵時有發情的行為表徵。無論母牛產後第一次發情表現或不表現發情行為之靜默發情，牛隻在發情前 3 – 4 天皆有一個過渡性的助孕素 (progesterone, P4) 高峰，其平均峰值濃度為  $0.88 \pm 0.15$  ng/mL ( $0.27 - 1.50$  ng/mL)。在產後有短週期發情的母牛，其發情前後均無伴隨助孕素濃度升高之情形，而在產後第一次發情為短週期的母牛中，有 75% 的母牛在第二次發情時成功受孕。母牛產後初次正常發情不論受孕與否，均發現在發情之前有助孕素濃度升高之情形。上述兩種情況之下，在恢復正常天數的動情週期或卵巢活動之後，接著都有伴隨助孕素濃度升高之情形。然而，由資料分析顯示，發情前助孕素濃度峰值大或小於 1 ng/mL，對產後發情間隔與後續的繁殖能力皆無顯著的差異。對產後初次發情為正常週期的母牛，其發情前 ( $P < 0.05$ ) 與發情後 ( $P < 0.005$ ) 的血漿中助孕素濃度皆顯著高於產後初次發情為短週期的母牛。哺育子女牛的母牛的發情前助孕素峰值比哺育仔公牛者為高 ( $P < 0.05$ )，但兩者在產後發情間隔與後續的繁殖能力上並無顯著差異。依上述結果顯示，臺灣黃牛的繁殖性能良好，且與其它肉牛品種者相近。

關鍵詞：臺灣黃牛、產後、繁殖、助孕素。

## 緒 言

產後乏情時間長度對肉牛生產效率之降低具有重要影響 (Ahmadzaeh *et al.*, 2011)，一頭母牛若欲保持一年一胎或 365 天產犢間隔 (胎距)，則必須在產後 80 至 85 天內再次受孕。一般而言，*Bos indicus* 牛產後繁殖間隔較 *Bos taurus* 牛為長 (Baker, 1969; D'occhio *et al.*, 1990)，而產後第一次發情配種的受孕率亦低於之後動情週期配種的受孕率 (Ramirez-Godinez *et al.*, 1981)。產後發情期的長短亦受胎次的影響 (Ahmadzadeh *et al.*, 2011)，初產母牛產後再次發情的間距會較經產母牛長，因初產母牛除了維持泌乳外，還需要更多能量供給自身生長，而體組成發育較泌乳與繁殖具有更大的優先權 (Short *et al.*, 1990)，經產母牛因生理已完全發育，因此產後營養可優先用於泌乳與繁殖，因此，初產母牛不但泌乳量較少，且產後在次發情的間隔會延長 (Stevenson, 2004)。短發情週期常見於哺乳中 (Rutter *et al.*, 1984) 或早期離乳 (Ramirez-Godinez *et al.*, 1982) 的肉牛、以及泌乳牛 (Savio *et al.*, 1990) 或擠乳中的乳牛 (Schams *et al.*, 1978)，其週期長度為 6 到 15 天不等；此現象也是產後初期影響繁殖效率的重要因子之一 (Gasser *et al.*, 2006; Lucy *et al.*, 2001; Short *et al.*, 1990; Stevenson *et al.*, 2003)。大部分的短動情週期發生在產後第一次與第二次動情週期之間 (Odde *et al.*, 1980)，且母牛在短動情週期後的下一發情時進行配種，具有極高之受孕率 (Corah *et al.*, 1974)。

由於助孕素來自黃體合成及分泌，因此血漿中的助孕素濃度是一個良好的黃體功能指標，並可用來監控產後的卵巢活動 (Peters, 1984)。母牛在產後初次發情之前，血中助孕素濃度會有上升之情形 (Donaldson *et al.*, 1970; Echtenkamp and Hansel, 1973; Kiracofe, 1980; Rawlings *et al.*, 1980; Humphrey *et al.*, 1983)，且其發生率從 *Bos indicus*

(1) 行政院農業委員會畜產試驗所研究報告第 2599 號。

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牛屬的 27.2% 至 *Bos taurus* 牛屬的 100% 不等。然而，母牛若有呈現產後短動情週期之情形，在發情期前該母牛常有助孕素濃度不會升高的現象 (Odde *et al.*, 1980; Ramirez-Godinez *et al.*, 1981)。據早期研究指出，短暫的助孕素濃度升高有助於正常發情與排卵的引發，進而提升繁殖力 (La Voie *et al.*, 1981)。母牛產後期間亦常發生靜默排卵的現象，呈現初次行為性發情 (Short *et al.*, 1990; Montiel and Ahuja, 2005) 或不具行為性發情徵候，而後者現象也常見於剛發身 (puberty) 的女牛 (Nelsen *et al.*, 1985; Rutter and Randel, 1986)。

臺灣黃牛 (Taiwan Yellow Cattle) 屬稀有本土品種 (Li *et al.*, 1994)，因此有關臺灣黃牛不同基礎性狀，諸如產後的繁殖生理和內分泌特性之調查有其必要，而深入瞭解臺灣黃牛產後階段的卵巢功能以及繁殖性能，將有助於母牛—仔牛之管理並改進其繁殖效率。本研究之目的即對臺灣黃牛產後階段的繁殖性狀與血漿中助孕素分泌情形進行探討。

## 材料與方法

### I. 試驗動物處理

本研究使用 13 頭 3-8 歲的產後臺灣黃牛，試驗期為 180 天，仔牛均伴隨母牛並可任意吮乳。所有母牛於分娩前後每天每頭給予 2 kg 精料、盤固乾草任食，體況維持中等至良好程度 (體況評分 5 到 7 之間，1 = 極瘦，9 = 極肥) (Eversole *et al.*, 2009)。發情觀察一天三次，時間分別為早上 8 時、下午 1 時、下午 5 時 30 分，每次觀察 30 – 60 分鐘。配戴下巴標記球 (chin-ball marker) 之種公牛從分娩季開始 30 天後即進入母牛群直至試驗結束。母牛被公牛或其他母牛穩定駕乘、配種、分泌黏液及其他躁動行為等皆會被記錄為發情。若母牛沒有發情的行為徵候，但在每日第一次觀察發情時身上已出現顏料記號，則視為前一天已經發情。從分娩 (第 0 天) 至產後第 21 天進行頸靜脈採血，頻率為每週一次；產後 21 到 45 天，每週採血兩次；之後直至產後第二次發情或試驗結束，則每兩天採血一次。血樣在採血完畢 30 分鐘內完成離心並分離血漿，直到分析前均於 -20°C 下凍存。

### II. 測定方法

本試驗血漿中助孕素之測定乃依據 Li and Wanger (1983) 的放射免疫分析法 (radioimmunoassay) 進行，助孕素-11 $\alpha$ -血清白蛋白的抗血清 (antiserum C467-B4)，由伊利諾大學醫學院獸醫生物科技系的 Dr. J. E. Hixon 所提供，抗血清使用時，以 0.1 M Tris 緩衝溶液 (pH 7.4) 稀釋 25,000 倍。抗血清之驗證方法參考 Weston and Hixon (1980) 之研究報告。等分混合的懷孕黃牛血樣作為對照組，組間及組內變異係數分別為 8.3 及 6.1%，分析的敏感度為 6.25 pg。第一次動情週期的定義如 Velez and Randel (1993) 所描述：短動情週期的定義為七日內連續兩次觀察到發情的間隔，並伴隨短暫的助孕素濃度上升；而靜默發情和 (或) 排卵則是未偵測到任何發情行為，但之後接著有正常天數的黃體期，且助孕素濃度一致性地大於 1 ng/mL，即認定為靜默發情和 (或) 排卵。懷孕期的判定是藉由持續性高濃度的助孕素且 (或) 經配種與分娩日期計算得出的正常懷孕天數。排卵或正常的卵巢活動被認為是由於受孕和 / 或助孕素濃度低於 1 ng/mL，然後接著有正常天數且助孕素濃度一致高於 1 ng/mL 的黃體期。受孕時間主要是依據配種日期與懷孕天數來估算。根據初次發情血漿中之助孕素濃度，可以將牛群歸為三類：(1) 第一次正常動情週期且發情有過渡性助孕素峰值，(2) 第一次動情週期天數少於 11 天，(3) 發情但不具功能性的黃體。

### III. 統計方法

受孕資料使用卡方分析法 (Chi-square, Iman *et al.*, 1983) 分析，產後發情或受孕間隔、以及血漿中助孕素濃度的分析均使用 SAS 一般線性模式程序 (general linear model procedure) 進行分析 (SAS, 2014)。最小平方平均來自 GLM 的 LSMEAMS。

## 結果與討論

臺灣黃牛主要的產後繁殖性狀如表 1 所示。其中 1 頭出現短週期發情的牛在試驗期間沒有受孕，故其產後至初次排卵與受孕的天數無法獲得及分析。其餘 5 頭 (38.5%) 和 7 頭 (53.8%) 分別於產後初次發情及第二次發情配種受孕，最終平均懷孕率為 92.3%。若以血漿中助孕素濃度將母牛產後初次動情週期之類型加以分類，可概分為三類：產後初次發情並具有正常卵巢週期之母牛最常見 (61.5%)，此類包含具發情行為與靜默發情者；其次為短動情週期者 (30.8%)，發生比例最低者為雖發情但不具功能性之黃體，占 7.7% (表 2)。

表 1. 臺灣黃牛產後之繁殖性狀

Table 1. Reproductive characteristics of Taiwan Yellow cows after parturition

Characteristics	n	Mean $\pm$ SE	Range
Total No. of cows	13		
Postpartum interval to ovulation (PPOI), days	12*	72.6 $\pm$ 11.1	35 – 152
Postpartum interval to estrus (PPEI), days	13	79.0 $\pm$ 10.1	41 – 152
Postpartum interval to conception (PPCI), days	12	83.9 $\pm$ 9.5	42 – 152
First service conception rate, %	5	38.5	
Pregnancy rate, %	12	92.3	

\* Four cows without subsequent plasma progesterone data were assumed to have ovulated, because on the day of estrus they were mated by the bull and then had a normal gestation length.

從助孕素濃度的分析數據顯示，13 頭母牛中有 11 頭 (84.6%) 在產後第一次發情之前並無卵巢活動的週期，其中 1 頭發情後接著有 1 次為靜默發情，而另 1 頭則接著有兩次靜默發情的情形。另依據助孕素分泌情形和懷孕狀態來看，12 頭牛共有 18 次的排卵現象，其中 78% (14/18) 的排卵伴隨著發情行為。83% (10/12) 的母牛在初次排卵前有發情行為，12 頭母牛中有 2 頭 (17%) 顯示在第一次正常卵巢週期前呈現靜默發情有排卵的情形。62% (8/13) 的產後母牛在初次發情時有排卵，而且之後有正常的黃體功能。

在所有 13 頭產後哺乳母牛當中，6 頭有初次正常動情週期的牛在發情前 3 – 4 天有短暫的助孕素上升現象，其平均峰值濃度為  $0.87 \pm 0.18$  ng/mL，而此助孕素分泌週期平均維持天數為  $7.5 \pm 0.3$  天。2 頭產後初次發情為靜默發情的母牛有同樣的分泌曲線，其助孕素分泌高峰在發情前四天出現，峰值為  $0.89 \pm 0.5$  ng/mL，平均維持天數為  $9.0 \pm 2.0$  天。4 頭出現產後初次短動情週期的牛和 1 頭有發情但未發展具功能性黃體的牛，均未出現發情前短暫的助孕素上升現象。整體而言，91.6% (11/12) 的母牛在產後初次排卵的 2 – 4 天前有短暫的助孕素上升，其助孕素高峰濃度為  $0.75 \pm 0.15$  ng/mL，平均維持天數為  $7.5 \pm 0.5$  天。4 頭產後初次發情為短動情週期的母牛，其中 3 頭助孕素濃度不超過 0.5 ng/mL，僅有 1 頭高於 1.5 ng/mL。若以血漿中助孕素濃度大於 1 ng/mL 做為黃體功能之指標，上述 3 頭母牛並不具功能性之黃體，因此在第二次發情配種時方得以受孕。

表 2. 臺灣黃牛產後第一次動情週期分布

Table 2. Distribution of cows in the first postpartum estrous cycle in Taiwan Yellow cows

Types of 1 <sup>st</sup> estrous cycle	n	%
Total No. of cows	13	
1 <sup>st</sup> normal estrous cycle	6	46.1
1 <sup>st</sup> silent heat	2	15.4
1 <sup>st</sup> short estrous cycle	4	30.8
1 <sup>st</sup> no P4 estrous cycle	1	7.7

當比較產後初次發情受孕與未受孕母牛的助孕素濃度 (圖 1)，兩者皆有發情前助孕素濃度上升情形，且在發情前 8 天至發情後 2 天的分泌情況均相似。自發情第 2 天到第 10 天，懷孕母牛的助孕素濃度逐漸增加，但空胎母牛仍維持低於 1.0 ng/mL 之狀態 ( $P < 0.05$ )。空胎母牛的助孕素濃度在第 14 天至 18 天時最高可上升至約 2.0 ng/mL，第 18 天後則急遽下降直到第二次發情，但懷孕母牛的助孕素濃度從第 10 至第 22 天則維持在 3.0 – 4.0 ng/mL 之間。若排除發情週期異常的牛隻 (圖 2)，則發情 (第 0 天) 到第 16 天的助孕素濃度在懷孕母牛與空胎母牛之間並無顯著差異存在。

與發情前助孕素濃度較低的母牛相比，助孕素濃度較高的母牛在產後到排卵、發情及受孕的間隔與其並無差異 (表 3)。產後第 1 次動情週期的相關繁殖性狀如表 4 所示，其中有 2 頭初次發情為靜默發情的牛並未列入。在正常動情週期的六頭母牛中，其中 4 頭因在第 1 次發情便受孕，只有 2 頭牛的完整動情週期天數被記錄。產後排卵、發情及受孕間隔在各組間無顯著差異。圖 3 顯示，在產後初次發情前後，第一次動情週期正常的母牛比第一次動情週期不正常的母牛有較高的助孕素濃度 ( $P < 0.05$ )。而第一次動情週期為短週期的母牛其助孕素濃度較低，明顯是因不正常的黃體功能所致。與哺乳仔公牛之母牛相較，哺乳子女牛之母牛有較高的暫時性助孕素濃度，但在其他的產後繁殖性狀方面則沒有發現差異 (表 5)。



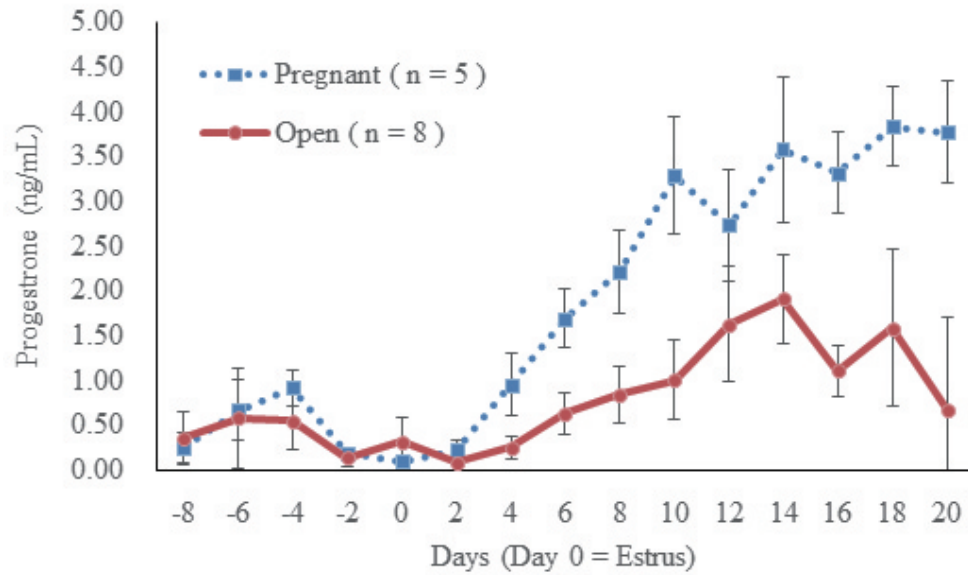


圖 1. 產後初次發情前後的血漿助孕素濃度之變化。

Fig. 1. Plasma progesterone profiles prior to and after first postpartum estrus.

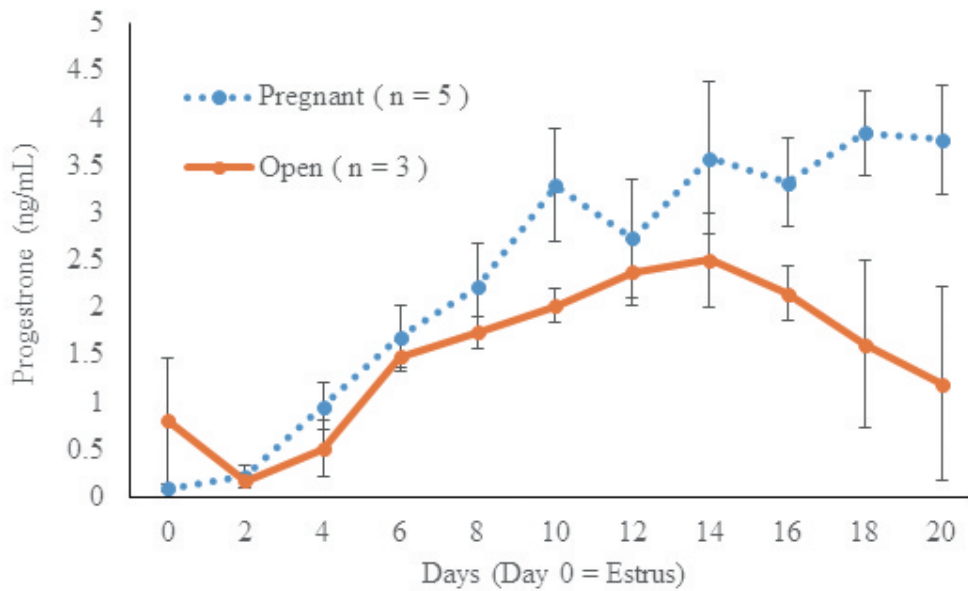


圖 2. 產後初次發情有正常黃體功能之動情週期的血漿助孕素濃度。

Fig. 2. Plasma progesterone profiles after first postpartum estrus followed by normal luteal function.

表 3. 產後母牛發情前不同助孕素峰值之產後繁殖性狀表現

Table 3. Postpartum reproductive traits in relation to the pre-estrus progesterone peak

Characteristics	P4 < 1 ng/mL (n = 8)	P4 > 1 ng/mL (n = 5)
Pre-estrus P <sub>4</sub> peak, ng/mL*	0.17 ± 0.20	1.74 ± 0.25
PPOI, days	69.1 ± 15.1**	77.4 ± 17.9
PPEI days	71.6 ± 13.0	90.8 ± 16.4
PPCI, days	72.1 ± 11.7**	100.4 ± 13.9
1 <sup>st</sup> service conception rate, %	25.0	60.0
Pregnancy rate, %	87.5	100.0

\* P < 0.05 between groups.

\*\* Number of observation = 7.

PPOI: Postpartum interval to ovulation; PPEI: Postpartum interval to estrus; PPCI: Postpartum interval to conception.

表 4. 母牛產後動情週期繁殖性狀之表現

Table 4. Postpartum estrous cycle characteristics

Characteristics	Normal estrous cycle (n = 6)	Short estrous cycle (n = 4)	No P4 (n = 1)
1 <sup>st</sup> cycle length, days <sup>***</sup>	21.5 ± 0.8 <sup>a</sup>	8.5 ± 0.6 <sup>b</sup>	26.0 <sup>c</sup>
PPOI, days	73.7 ± 16.4	76.3 ± 23.2	123.0
PPEI, days	73.7 ± 17.7	86.0 ± 21.6	97.0
PPCI, days	80.8 ± 14.8	76.3 ± 21.0	123.0
Pre-estrus P <sub>4</sub> peak, ng/mL <sup>*</sup>	0.87 ± 0.18 <sup>a</sup>	0.03 ± 0.21 <sup>b</sup>	0.05 <sup>ab</sup>
Peak P <sub>4</sub> concentration, ng/mL <sup>**</sup>	3.92 ± 0.53 <sup>a</sup>	0.69 ± 0.65 <sup>b</sup>	0.02 <sup>b</sup>

<sup>\*</sup> Means without the same superscripts within the same row differ ( $P < 0.05$ ).

<sup>\*\*</sup> Means with different superscripts within the same row differ ( $P < 0.005$ ).

<sup>\*\*\*</sup> Means with different superscripts within the same row differ ( $P < 0.001$ ).

PPOI: Postpartum interval to ovulation; PPEI: Postpartum interval to estrus; PPCI: Postpartum interval to conception.

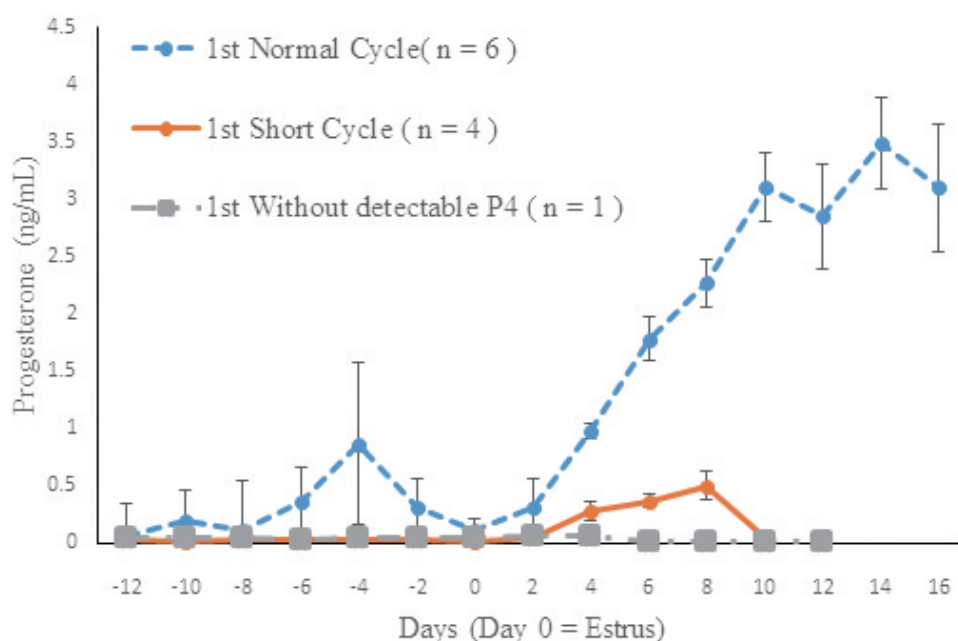


圖 3. 產後初次動情週期中母牛血漿助孕素濃度之變化。

Fig. 3. Plasma progesterone profile in relation to the first postpartum estrous cycle.

表 5. 哺乳仔牛性別對母牛產後繁殖性狀之影響

Table 5. Postpartum reproductive characteristics of cows influenced by calf sex<sup>\*</sup>

Characteristics	Bull calves (n = 6)	Heifer calves (n = 7)
PPOI, days	66.0 ± 17.8 <sup>**</sup>	77.3 ± 15.0
PPEI, days	75.8 ± 15.5	81.7 ± 14.3
PPCI, days	74.4 ± 15.0 <sup>**</sup>	90.7 ± 12.6
1 <sup>st</sup> service conception rate, %	33.3	42.9
Pregnancy rate, %	83.3	100.0
Transient rise in progesterone, ng/mL	0.30 ± 0.18 <sup>**</sup>	0.96 ± 0.16

<sup>\*</sup> Only the transient progesterone peaks differ between groups ( $P < 0.05$ ).

<sup>\*\*</sup> Number of observation = 5.

PPOI: Postpartum interval to ovulation; PPEI: Postpartum interval to estrus; PPCI: Postpartum interval to conception.

產後至排卵、發情及受孕之間隔可能因為不同的遺傳與環境因素，在不同類型牛種之間有不同的現象 (Ahmadzadeh *et al.*, 2011)。產後初次發情配種的受孕率呈負相關 (Hess *et al.*, 2005)，在本研究中亦得到證實；而在本研究中分娩後初次短週期的高比例現象也與先前研究相同 (Ramirez-Godinez *et al.*, 1982; Zerbini *et al.*, 1993)。但臺灣黃牛母牛在產後可偵測初次發情前出現靜默發情的比例，則較 *Bos indicus* 牛種為低 (15.3% v.s 29.4%) (Dawuda *et al.*, 1989)。

本研究關於產後初次發情前後第一次排卵的結果與 Wetteman (1980) 所述相似，許多研究者皆觀察到在產後有相當高的靜默排卵發生率 (Schams *et al.*, 1978; Murphy *et al.*, 1990; Savio *et al.*, 1990)，然而本研究顯示，臺灣黃牛產後的初次排卵通常伴隨發情行為。如果依據總排卵數來看，僅有 22% 的母牛排卵沒有發情行為，比其他報告 (Mukasa-Mugerwa *et al.*, 1991a; Togegne *et al.*, 1993; Zerbini *et al.*, 1993) 的 36 到 72% 為低。綜言之，產後初次靜默發情並不影響後續正常動情週期的懷孕率。

產後具短動情週期的母牛在第一次助孕素上升前顯示初次發情的現象與其他研究相同 (Corah *et al.*, 1974; Odde *et al.*, 1980)，且臺灣黃牛的調查結果也證實了其他研究的相同現象，即產後經歷短週期發情的母牛，不會因此而影響後續的繁殖能力 (Lamming *et al.*, 1981; Ramirez-Godinez *et al.*, 1981; Mukasa-Mugerwa *et al.*, 1991b; Togegne *et al.*, 1993)。根據 Rutter and Randel (1984) 以及其他研究者的推論，黃體組織與短期黃體均無法形成的情形，可能為母牛產後初次發情配種受孕率低的原因，在本研究中也發現此現象。有關黃體功能限縮或黃體發育停滯的原因，則尚待後續進一步之研究。

本研究調查在產後初次正常或靜默動情週期前助孕素濃度會過渡性的短暫增加之結果與較早的研究結果相符 (Donaldson *et al.*, 1970; Arije *et al.*, 1974; Rawlings *et al.*, 1980; Humphrey *et al.*, 1983)。Corah (1974) 指出，發情前助孕素濃度上升的現象只在配種後受孕的女牛出現，但本研究發現這種情形在未受孕的母牛中亦存在，顯示發情前助孕素濃度之上升，不僅是之後發情與 (或) 排卵受孕的必要條件，也是卵巢功能正常發展所必需。Ramirez-Godinez *et al.* (1981) 和 Murphey *et al.* (1990) 發現，在短動情週期前或靜默發情、行為性發情前助孕素的暫時性升高，後續均會恢復正常天數的動情週期或正常的卵巢活動。本研究中，產後正常空胎母牛的助孕素分泌狀態與之前調查臺灣黃牛暖季的分泌型態類似 (Li *et al.*, 1994)。La Voie *et al.* (1981) 的報告顯示，發情前助孕素峰值較高的母牛有產後發情間隔較長之趨勢；但本研究則顯示，發情前助孕素峰值高低對母牛產後發情間隔並無明顯影響。

本研究中，臺灣黃牛母牛產後初次動情週期的天數與其他肉牛品種的調查結果相似 (Manns *et al.*, 1983; Garverick *et al.*, 1988; Murphy *et al.*, 1990)。La Voie *et al.* (1981) 指出，產後發情間隔的長度與產後初次動情週期的長度有正相關。雖然本研究未能觀察出差異性的存在，但短動情週期的母牛要比正常動情週期的母牛多花 12 天恢復發情，與前人研究結果相似 (Rutter and Randel, 1984)。而產後初次動情週期正常的母牛在發情前後的助孕素濃度比產後初次短週期的母牛為高，此結果也與其他研究一致 (Rutter and Randel, 1984; Velez and Randel, 1993)。

Bellows *et al.* (1982) 與 Custer *et al.* (1990) 的報告指出，哺乳仔公牛與子女牛對母牛產後發情間隔會有差異存在，且哺乳為影響產後發情期長短的主要因素之一 (Yavas and Walton, 2000; Lamb, 2000)，持續哺乳會阻止排卵，延長產後的不發情期，並降低繁殖效率。本研究的發現亦與 Custer *et al.* (1990) 的結果相同，即哺乳小女牛的母牛需花較多時間恢復卵巢活動；而本研究哺乳子女牛的母牛有較高受孕率與懷孕率的結果，亦與 Bellows *et al.* (1982) 的報告一致。

以上研究觀察顯示，臺灣黃牛的繁殖能力良好，且 365 天產犢間隔 (胎距) 的目標是可以達成的。產後初次正常的動情週期前，助孕素濃度的暫時性升高，在懷孕期及產後的乏情階段中，扮演了啟動卵巢活動的角色。雖然沒有顯著差異，但發情前助孕素峰值較高 (至少接近 1 ng/mL) 的母牛，似乎有較長的產後排卵、發情及受孕間隔，同時也有較高的受孕率。關於臺灣黃牛產後助孕素濃度與性賀爾蒙的交互關聯性，有待進一步的研究，以期對臺灣黃牛的繁殖特性能有更深入的了解。

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# Postpartum progesterone levels and reproductive characteristics of Taiwan Yellow Cattle <sup>(1)</sup>

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Received: Jun. 25, 2018; Accepted: Mar. 7, 2019

## Abstract

This investigation was conducted to determine reproduction and progesterone profiles during the postpartum period in 13, Taiwan Yellow cows with 3 to 8-year-old. Plasma progesterone (P4) concentrations were used to illustrate ovarian activity and pregnancy. Calves were allowed to suckle ad libitum, and a fertile marker bull was maintained with the herd throughout the trial. Days from calving to conception ( $83.9 \pm 9.5$  d) and pregnancy rate (92.3%) showed that these indigenous cattle can attain a calving interval of 365 days with adequate fertility. Cows had 30.8% first short estrous cycles with 7 to 10 days. Most of the cows exhibited first estrus without previous ovarian activity, 78% of the ovulations were associated with behavioral estrus and 83% of the cows had behavioral estrus at their first ovulation. A mean transient progesterone peak with  $0.88 \pm 0.15$  ng/mL (range 0.27 to 1.50 ng/mL) was observed 3 to 4 days prior to either the first behavioral estrus or silent estrus. No pre-estrus increasing in progesterone was exhibited on cows with short estrous cycles or no progesterone increasing following estrus. Seventy-five percents of the cows with short first estrous cycles conceived at the second estrus. The pre-estrus increased in progesterone was found in cows which conceived or did not conceive in relation to the first postpartum estrus. In both cases, the resumption of estrous cycles of normal length or normal ovarian activity was proceeded by increasing in progesterone. However, if data were analyzed by the pre-estrus progesterone peak with greater or less than 1 ng/mL, no differences were found in postpartum interval and subsequent fertility. Prior to ( $P < 0.05$ ) and following ( $P < 0.005$ ) the first estrus, the plasma progesterone was higher in cows with normal first estrous cycles than those with short first estrous cycles. The magnitude of the pre-estrus progesterone peak for cows suckled heifer calves was greater ( $P < 0.05$ ) than those suckled bull calves. However no differences were observed in postpartum intervals or subsequent fertility. The results showed that reproductive performance demonstrated by Taiwan Yellow cows was adequate and similar to that found in the other beef breeds.

Key words: Taiwan Yellow cattle, Postpartum, Reproduction, Progesterone.

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(1) Contribution No. 2599 from Livestock Research Institute, Council of Agriculture, Executive Yuan.

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