

Diagrams showing all 16 probable outcomes after each covering (there are 4 genes involved in each horse: LP, lp, PATN and patn so 4X4=16), the diagrams are called Punnett-squares. Remember that the coveted fullspotted variety only turns up if the genetic result is either **LPlp/PATNpatn** or **LPlp/PATNPATN** that is if there is one and only one LP gene plus one or two PATN genes. Also remember that we are talking about probabilities, this means in for example diagram 1 there is a 25% chance of getting fullspotted offspring or that after very many coverings 25% of the offspring will be fullspotted. Instead of using a fullspotted mare or stallion with only one PATN gene as in diagram 1 you use one with two PATN genes like in diagram 2 the chances for fullspotted offspring doubles and the “risk” of getting solid coloureds with no characteristics and minimally coloureds disappears.

In diagrams 6, 10, 12, 17, 22 og 23 it can be seen that whites do not always produce spots! In diagrams 31, 32 og 33 it can be seen that also minimally coloured X solid coloured also can produce spots and in 34 you see this will happen every time. It will in the diagrams also be seen that fullspotteds never will be able to produce fullspotted offspring every time. The ultimate covering is seen in diagram 9 (**white type 1 X solid coloured Knabstrupper**), where all offspring will be fullspotted with maximum white every time.

Also bear in mind that the PATN is not only one gene that makes white but a whole family of genes, in the diagrams are only that full-body-sized or 100% PATN gene which is most commonly found in the Knabstrupper.

Legend: (Capital letters indicate the gene is present or in the “on” position, small letters that it isn’t)

Red = fullspotted, type 1 = **LPlp/PATNPATN**, type 2 = **LPlp/PATNpatn**

Blue = 1/4 spotted/LP-roaned/spots on hind/ minimal colour distribution/ultimately solid coloured with only white sclera, striped hooves etc., no PATN gene

Green = solid coloured, minimal distribution of PATN gene, no LP gene

Black = solid coloured, neither LP nor PATN gene

Yellow = whiteborn (or white) type 1 = **LPLP/PATNPATN** and type 2 = **LPLP/PATNpatn**

Diagram 1: LPlp/PATNpatn (fullspotted type 2) X lplp/patnpatn (solid coloured f.ex. WB)

LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn
LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn
lplp/PATNpatn	lplp/PATNpatn	lplp/PATNpatn	lplp/PATNpatn
lplp/patnpatn	lplp/patnpatn	lplp/patnpatn	lplp/patnpatn

Diagram 2: LPlp/PATNPATN (fullspotted type 1) X lplp/patnpatn (solid coloured f.ex. WB)

LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn
LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN
lplp/PATNpatn	lplp/PATNpatn	lplp/PATNpatn	lplp/PATNpatn
lplp/PATNPATN	lplp/PATNPATN	lplp/PATNPATN	lplp/PATNPATN

Diagram 3: LPlp/PATNpatn (fullspotted type 2) X LPlp/PATNpatn (fullspotted type 2)

LPLP/PATNPATN	LPLP/PATNpatn	LPLP/PATNpatn	LPLP/patnpatn
LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNpatn	LPlp/PATNpatn
LPlp/PATNpatn	LPlp/PATNpatn	LPlp/patnpatn	LPlp/patnpatn
lplp/PATNPATN	lplp/PATNpatn	lplp/PATNpatn	lplp/patnpatn

Diagram 4: LPlp/PATNPATN (fullspotted type 1) X LPlp/PATNpatn (fullspotted type 2)

LPLP/PATNPATN	LPLP/PATNPATN	LPLP/PATNpatn	LPLP/PATNpatn
LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN
LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn
lplp/PATNPATN	lplp/PATNPATN	lplp/PATNpatn	lplp/PATNpatn

Diagram 5: LPlp/PATNPATN (fullspotted type 1) X LPlp/PATNPATN (fullspotted type 1)

LPLP/PATNPATN	LPLP/PATNPATN	LPLP/PATNPATN	LPLP/PATNPATN
LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN
LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN
lplp/PATNPATN	lplp/PATNPATN	lplp/PATNPATN	lplp/PATNPATN

Diagram 6: LPLP/PATNpatn (white type 2) X lplp/patnpatn (solid coloured f.ex. WB)

LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn
LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn
LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn
LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn

Diagram 7: LPLP/PATNPATN (white type 1) X lplp/patnpatn (solid coloured f.ex. WB)

LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn
LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn
LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn
LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn

Diagram 8: LPLP/PATNpatn (white type 2) X lplp/PATNPATN (solid coloured Knabs.)

LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN
LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN
LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn
LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn

Diagram 9: LPLP/PATNPATN (white type 1) X lplp/PATNPATN (solid coloured Knabs.)

LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN
LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN
LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN
LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN

Diagram 10: LPLP/PATNpatn (white type 2) X lplp/PATNpatn (solid coloured Knabs.)

LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN
LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn
LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn
LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn

Diagram 11: LPLP/PATNPATN (white type 1) X lplp/PATNpatn (solid coloured Knabs.)

LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN
LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN
LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn
LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn

Diagram 12: LPLP/PATNpatn (white type 2) X LPlpPATNpatn (fullspotted type 2)

LPLP/PATNPATN	LPLP/PATNPATN	LPLP/PATNpatn	LPLP/PATNpatn
LPLP/PATNpatn	LPLP/PATNpatn	LPlp/PATNPATN	LPlp/PATNPATN
LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn
LPLP/patnpatn	LPLP/patnpatn	LPlp/patnpatn	LPlp/patnpatn

Diagram 13: LPLP/PATNPATN (white type 1) X LPlp/PATNpatn (fullspotted type 2)

LPLP/PATNPATN	LPLP/PATNPATN	LPLP/PATNPATN	LPLP/PATNPATN
LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn
LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN
LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn

Diagram 14: LPLP/PATNpatn (white type 2) X LPlp/PATNPATN (fullspotted type 1)

LPLP/PATNPATN	LPLP/PATNPATN	LPLP/PATNPATN	LPLP/PATNPATN
LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn
LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN
LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn

Diagram 15: LPLP/PATNPATN (white type 1) X LPlp/PATNPATN (fullspotted type 1)

LPLP/PATNPATN	LPLP/PATNPATN	LPLP/PATNPATN	LPLP/PATNPATN
LPLP/PATNPATN	LPLP/PATNPATN	LPLP/PATNPATN	LPLP/PATNPATN
LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN
LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN

Diagram 16: LPLP/PATNPATN (white type 1) X LPLP/PATNpatn (white type 2)

LPLP/PATNPATN	LPLP/PATNPATN	LPLP/PATNPATN	LPLP/PATNPATN
LPLP/PATNPATN	LPLP/PATNPATN	LPLP/PATNPATN	LPLP/PATNPATN
LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn
LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn

Diagram 17: LPLP/PATNpatn (white type 2) X LPLP/PATNpatn (white type 2)

LPLP/PATNPATN	LPLP/PATNPATN	LPLP/PATNPATN	LPLP/PATNPATN
LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn
LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn
LPLP/patnpatn	LPLP/patnpatn	LPLP/patnpatn	LPLP/patnpatn

Diagram 18: LPlp/patnpatn (minimal colour) X LPlp/PATNpatn (fullspotted type 2)

LPLP/PATNpatn	LPLP/PATNpatn	lplp/PATNpatn	lplp/PATNpatn
LPLP/patnpatn	LPLP/patnpatn	LPlp/patnpatn	LPlp/patnpatn
LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn
LPlp/patnpatn	LPlp/patnpatn	lplp/patnpatn	lplp/patnpatn

Diagram 19: LPlp/patnpatn (minimal colour) X LPlp/PATNPATN (fullspotted type 1)

LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn
LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn
LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn
lplp/PATNpatn	lplp/PATNpatn	lplp/PATNpatn	lplp/PATNpatn

Diagram 20: LPLP/patnpatn (minimal colour) X LPlp/PATNpatn (fullspotted type 2)

LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn
LPLP/patnpatn	LPLP/patnpatn	LPLP/patnpatn	LPLP/patnpatn
LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn
LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn

Diagram 21: LPLP/patnpatn (minimal colour) X LPlp/PATNPATN (fullspotted type 1)

LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn
LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn
LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn
LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn

Diagram 22: LPlp/patnpatn (minimal colour) X LPLP/PATNpatn (white type 2)

LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn
LPLP/patnpatn	LPLP/patnpatn	LPLP/patnpatn	LPLP/patnpatn
LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn
LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn

Diagram 23: LPLP/patnpatn (minimal colour) X LPLP/PATNpatn (white type 2)

LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn
LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn
LPLP/patnpatn	LPLP/patnpatn	LPLP/patnpatn	LPLP/patnpatn
LPLP/patnpatn	LPLP/patnpatn	LPLP/patnpatn	LPLP/patnpatn

Diagram 24: LPlp/patnpatn (minimal colour) X LPLP/PATNPATN (white type 1)

LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn
LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn
LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn
LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn

Diagram 25: LPLP/patnpatn (minimal colour) X LPLP/PATNPATN (white type 1)

LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn
LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn
LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn
LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn	LPLP/PATNpatn

Diagram 26: LPlp/patnpatn (minimal colour) X LPlp/patnpatn (minimal colour)

LPLP/patnpatn	LPLP/patnpatn	LPLP/patnpatn	LPLP/patnpatn
LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn
LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn
lplp/patnpatn	lplp/patnpatn	lplp/patnpatn	lplp/patnpatn

Diagram 27: LPlp/patnpatn (minimal colour) X LPLP/patnpatn (minimal colour)

LPLP/patnpatn	LPLP/patnpatn	LPLP/patnpatn	LPLP/patnpatn
LPLP/patnpatn	LPLP/patnpatn	LPLP/patnpatn	LPLP/patnpatn
LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn
LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn

Diagram 28: LPLP/patnpatn (minimal colour) X LPLP/patnpatn (minimal colour)

LPLP/patnpatn	LPLP/patnpatn	LPLP/patnpatn	LPLP/patnpatn
LPLP/patnpatn	LPLP/patnpatn	LPLP/patnpatn	LPLP/patnpatn
LPLP/patnpatn	LPLP/patnpatn	LPLP/patnpatn	LPLP/patnpatn
LPLP/patnpatn	LPLP/patnpatn	LPLP/patnpatn	LPLP/patnpatn

Diagram 29: LPlp/patnpatn (minimal colour) X lplp/patnpatn (solid colour f.ex. WB)

LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn
LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn
lplp/patnpatn	lplp/patnpatn	lplp/patnpatn	lplp/patnpatn
lplp/patnpatn	lplp/patnpatn	lplp/patnpatn	lplp/patnpatn

Diagram 30: LPLP/patnpatn (minimal colour) X lplp/patnpatn (solid colour f.ex. WB)

LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn
LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn
LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn
LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn

Diagram 31: LPlp/patnpatn (minimal colour) X lplp/PATNpatn (solid colour Knabs.)

LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn
LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn
lplp/PATNpatn	lplp/PATNpatn	lplp/PATNpatn	lplp/PATNpatn
lplp/patnpatn	lplp/patnpatn	lplp/patnpatn	lplp/patnpatn

Diagram 32: LPLP/patnpatn (minimal colour) X lplp/PATNpatn (solid colour Knabs.)

LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn
LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn
LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn
LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn	LPlp/patnpatn

Diagram 33: LPlp/patnpatn (minimal colour) X lplp/PATNPATN (solid colour Knabs.)

LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn
LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn
lplp/PATNpatn	lplp/PATNpatn	lplp/PATNpatn	lplp/PATNpatn
lplp/PATNpatn	lplp/PATNpatn	lplp/PATNpatn	lplp/PATNpatn

Diagram 34: LPLP/patnpatn (minimal colour) X lplp/PATNPATN (solid colour Knabs.)

LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn
LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn
LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn
LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn

Diagram 35: LPlp/PATNpatn (fullspotted type 2) X lplp/PATNpatn (solid colour Knabs.)

LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNpatn	LPlp/PATNpatn
LPlp/PATNpatn	LPlp/PATNpatn	LPlp/patnpatn	LPlp/patnpatn
lplp/PATNPATN	lplp/PATNPATN	lplp/PATNpatn	lplp/PATNpatn
lplp/PATNpatn	lplp/PATNpatn	lplp/patnpatn	lplp/patnpatn

Diagram 36: LPlp/PATNPATN (fullspotted type 1) X lplp/PATNpatn (solid colour Knabs.)

LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN
LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn
lplp/PATNPATN	lplp/PATNPATN	lplp/PATNPATN	lplp/PATNPATN
lplp/PATNpatn	lplp/PATNpatn	lplp/PATNpatn	lplp/PATNpatn

Diagram 37: LPlp/PATNpatn (fullspotted type 2) X lplp/PATNPATN(solid colour Knabs.)

LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN
LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn	LPlp/PATNpatn
lplp/PATNPATN	lplp/PATNPATN	lplp/PATNPATN	lplp/PATNPATN
lplp/PATNpatn	lplp/PATNpatn	lplp/PATNpatn	lplp/PATNpatn

Diagram 38: LPlp/PATNPATN (fullspotted type 1) X lplp/PATNPATN(solid colour Knabs.)

LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN
LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN	LPlp/PATNPATN
lplp/PATNPATN	lplp/PATNPATN	lplp/PATNPATN	lplp/PATNPATN
lplp/PATNPATN	lplp/PATNPATN	lplp/PATNPATN	lplp/PATNPATN

Note: Especially for blue it is notoriously difficult to define the colour.

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