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Heineken Supply Chain B.V.

<120> Energy saving brewing method

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<170> PatentIn version 3.5

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Leu Glu Ser Arg Leu Ser Leu Leu Glu Gln Ile Tyr Val Pro Arg Asp
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Glu Lys Phe Gly His Leu Lys Thr Ser Asp Phe Leu Gly Tyr Ser Ile
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Glu Gly Gly Ile Lys Leu Pro Lys Val Ala Ala Leu Glu Glu Leu Arg
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<212> PRT

<213> Hordeum vulgare cv: Barke

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Asp Phe Asn Asp Phe Gly Ala His Val Met Asp Gly Val Thr Glu Leu
35 40 45

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Leu Gly Arg Gly Val Thr Cys Gln Leu Ile Ser Ser Thr Asn Val Asp
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 His Asn Asn Gly Gly Arg Gly Lys Val Gly Ala Glu Ala Asn Leu Glu
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 Gln Trp Leu Leu Pro Thr Asn Leu Pro Phe Ile Thr Thr Gly Glu Asn
 85 90 95
 Lys Phe Ala Val Thr Phe Asp Trp Ser Val Asp Lys Leu Gly Val Pro
 100 105 110
 Gly Ala Ile Ile Val Lys Asn Asn His Ala Ser Glu Phe Phe Leu Lys
 115 120 125
 Thr Ile Thr Leu Asp Asn Val Pro Gly Arg Gly Thr Ile Val Phe Val
 130 135 140
 Ala Asn Ser Trp Val Tyr Pro Gln Ala Lys Tyr Arg Tyr Asn Arg Val
 145 150 155 160
 Phe Phe Ala Asn Asp Thr Tyr Leu Pro His Gln Met Pro Ala Ala Leu
 165 170 175
 Lys Pro Tyr Arg Asp Asp Glu Leu Arg Asn Leu Arg Gly Asp Asp Gln
 180 185 190
 Gln Gly Pro Tyr Leu Asp His Asp Arg Val Tyr Arg Tyr Asp Val Tyr
 195 200 205
 Asn Asp Leu Gly Asp Ser Arg Asp Val Leu Gly Gly Ser Lys Asp Leu
 210 215 220
 Pro Tyr Pro Arg Arg Cys Arg Thr Gly Arg Lys Pro Ser Asp Ser Lys
 225 230 235 240
 Pro Asp His Glu Ser Arg Leu Leu Leu Leu Val Gln Asn Val Tyr Val
 245 250 255
 Leu Arg Asp Glu Leu Phe Gly His Leu Lys Gln Ser Asp Leu Leu Gly
 260 265 270
 Tyr Thr Leu Lys Gly Trp Leu Asp Gly Ile Ile Leu Ala Ile Arg Thr
 275 280 285
 Tyr Val Asp Leu Ser Pro Gly Glu Phe Asp Ser Phe Ala Asp Ile Leu
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 Lys Leu Tyr Glu Gly Gly Ile Lys Leu Pro Asn Ile Pro Ala Leu Glu
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 Val Asp Gln Lys Ala Trp Met Thr Asp Glu Glu Phe Ala Arg Glu Met
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 Leu Ala Gly Val Asn Pro Met Met Ile Lys Arg Leu Thr Glu Phe Pro
 370 375 380
 Pro Lys Ser Thr Leu Asp Pro Ser Lys Tyr Gly Asp His Thr Ser Thr
 385 390 395 400
 Met Thr Glu Glu His Val Ala Lys Ser Leu Glu Gly Leu Thr Val Gln
 405 410 415
 Gln Ala Leu Ala Gly Asn Arg Leu Tyr Ile Val Asp Gln His Asp Asn
 420 425 430
 Leu Met Pro Phe Leu Ile Asp Ile Asn Asn Leu Asp Ala Ser Phe Val
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 450 455 460
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 465 470 475 480
 Thr Ala Lys Ser Ala Val Tyr Thr Pro Gln His Ala Gly Val Glu Gly
 485 490 495
 Trp Ile Trp Gln Leu Ala Lys Ala Tyr Ala Ser Val Asn Asp Tyr Gly
 500 505 510
 Trp His Gln Leu Ile Ser His Trp Leu Asn Thr His Ala Val Met Glu
 515 520 525
 Pro Phe Val Ile Ala Thr Asn Arg Gln Leu Ser Val Thr His Pro Val
 530 535 540
 Tyr Lys Leu Leu His Pro His Tyr Arg Asp Thr Met Asn Ile Asn Ala
 545 550 555 560
 Arg Ala Arg Gly Leu Leu Ile Asn Ala Gly Gly Val Ile Glu Met Thr
 565 570 575
 Val Phe Pro His Lys His Ala Met Pro Met Ser Ser Met Val Tyr Lys
 580 585 590

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His Trp Asn Phe Thr Glu Gln Ala Leu Pro Ala Asp Leu Ile Lys Arg
595 600 605

Gly Met Ala Val Glu Asp Ala Ser Ser Pro His Lys Val Arg Leu Leu
610 615 620

Ile Lys Asp Tyr Pro Tyr Ala Thr Asp Gly Leu Ala Val Trp Asp Ala
625 630 635 640

Ile Glu Gln Trp Val Ser Asp Tyr Leu Thr Ile Tyr Tyr Pro Asn Asp
645 650 655

Gly Val Leu Gln Gly Asp Val Glu Leu Gln Ala Trp Trp Lys Glu Val
660 665 670

Arg Glu Val Gly His Gly Asp Leu Lys Asp Ala Ala Trp Trp Pro Lys
675 680 685

Met Gln Thr Val Ala Glu Leu Ile Lys Ala Cys Ala Thr Ile Ile Trp
690 695 700

Thr Gly Ser Ala Leu His Ala Ala Val Asn Phe Gly Gln Tyr Pro Tyr
705 710 715 720

Ser Gly Tyr His Pro Asn Lys Pro Ser Ala Ser Arg Arg Pro Met Pro
725 730 735

Val Gln Gly Ser Glu Glu Tyr Ala Glu Leu Glu Arg Asp Pro Glu Lys
740 745 750

Ala Phe Ile Arg Thr Ile Thr Ser Gln Phe His Ala Leu Val Gly Ile
755 760 765

Ser Leu Met Glu Ile Leu Ser Lys His Ser Ser Asp Glu Val Tyr Leu
770 775 780

Gly Gln His Asp Thr Pro Ala Trp Thr Ser Asp Ala Lys Ala Leu Glu
785 790 795 800

Ala Phe Lys Arg Phe Gly Ala Lys Leu Glu Gly Ile Glu Lys Gln Val
805 810 815

Val Ala Met Asn Ser Asp Pro Gln Leu Lys Asn Arg Thr Gly Pro Ala
820 825 830

Lys Phe Pro Tyr Met Leu Leu Tyr Pro Asn Thr Ser Asp His Thr Gly
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Leu Gly Arg Gly Val Thr Cys Gln Leu Ile Ser Ser Thr Asn Val Asp
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His Asn Asn Gly Gly Arg Gly Lys Val Gly Ala Glu Ala Asn Leu Glu
 65 70 75 80

Gln Trp Leu Leu Pro Thr Asn Leu Pro Phe Ile Thr Thr Gly Glu Asn
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Lys Phe Ala Val Thr Phe Asp Trp Ser Val Asp Lys Leu Gly Val Pro
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Gly Ala Ile Ile Val Lys Asn Asn His Ala Ser Glu Phe Phe Leu Lys
 115 120 125

Thr Ile Thr Leu Asp Asn Val Pro Gly Arg Gly Thr Ile Val Phe Val
 130 135 140

Ala Asn Ser Trp Val Tyr Pro Gln Ala Lys Tyr Arg Tyr Asn Arg Val
 145 150 155 160

Phe Phe Ala Asn Asp Thr Tyr Leu Pro His Gln Met Pro Ala Ala Leu
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Lys Pro Tyr Arg Asp Asp Glu Leu Arg Asn Leu Arg Gly Asp Asp Gln
 180 185 190

Gln Gly Pro Tyr Leu Asp His Asp Arg Val Tyr Arg Tyr Asp Val Tyr
 195 200 205

Asn Asp Leu Gly Asp Ser Arg Asp Val Leu Gly Gly Ser Lys Asp Leu
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Pro Tyr Pro Arg Arg Cys Arg Thr Gly Arg Lys Pro Ser Asp Ser Lys
 225 230 235 240

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Pro Asp His Glu Ser Arg Leu Leu Leu Leu Val Gln Asn Val Tyr Val
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Leu Arg Asp Glu Leu Phe Gly His Leu Lys Gln Ser Asp Leu Leu Gly
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Tyr Thr Leu Lys Gly Trp Leu Asp Gly Ile Ile Leu Ala Ile Arg Thr
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Tyr Val Asp Leu Ser Pro Gly Glu Phe Asp Ser Phe Ala Asp Ile Leu
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Lys Leu Tyr Glu Gly Gly Ile Lys Leu Pro Asn Ile Pro Ala Leu Glu
305 310 315 320
Glu Val Arg Lys Arg Phe Pro Leu Gln Leu Val Lys Asp Leu Ile Pro
325 330 335
Lys Gly Gly Asp Phe Leu Leu Lys Leu Pro Lys Pro Glu Ile Ile Lys
340 345 350
Val Asp Gln Lys Ala Trp Met Thr Asp Glu Glu Phe Ala Arg Glu Met
355 360 365
Leu Ala Gly Val Asn Pro Met Met Ile Lys Arg Leu Thr Glu Phe Pro
370 375 380
Pro Lys Ser Thr Leu Asp Pro Ser Lys Tyr Gly Asp His Thr Ser Thr
385 390 395 400
Met Thr Glu Glu His Val Ala Lys Ser Leu Glu Gly Leu Thr Val Gln
405 410 415
Gln Ala Leu Ala Gly Asn Arg Leu Tyr Ile Val Asp Gln His Asp Asn
420 425 430
Leu Met Pro Phe Leu Ile Asp Ile Asn Asn Leu Asp Ala Ser Phe Val
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450 455 460
Pro Val Ala Ile Glu Leu Ser Ser Pro Leu Ile Gln Gly Glu Leu Thr
465 470 475 480
Thr Ala Lys Ser Ala Val Tyr Thr Pro Gln His Ala Gly Val Glu Gly
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Trp Ile Trp Gln Leu Ala Lys Ala Tyr Ala Ser Val Asn Asp Tyr Gly
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pctdk2011050186-seq1

Trp His Gln Leu Ile Ser His Trp Leu Asn Thr His Ala Val Met Glu
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Pro Phe Val Ile Ala Thr Asn Arg Gln Leu Ser Val Thr His Pro Val
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Tyr Lys Leu Leu His Pro His Tyr Arg Asp Thr Met Asn Ile Asn Ala
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Arg Ala Arg Gly Leu Leu Ile Asn Ala Gly Gly Val Ile Glu Met Thr
565 570 575

Val Phe Pro His Lys His Ala Met Pro Met Ser Ser Met Val Tyr Lys
580 585 590

His Trp Asn Phe Thr Glu Gln Ala Leu Pro Ala Asp Leu Ile Lys Arg
595 600 605

Gly Met Ala Val Glu Asp Ala Ser Ser Pro His Lys Val Arg Leu Leu
610 615 620

Ile Lys Asp Tyr Pro Tyr Ala Thr Asp Gly Leu Ala Val Trp Asp Ala
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Ile Glu Gln Trp Val Ser Asp Tyr Leu Thr Ile Tyr Tyr Pro Asn Asp
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Ser Ile Phe Ile Pro Glu Asp Trp Ser Phe Thr Phe Tyr Glu Gly Leu
 100 105 110

Asn Arg His Pro Asp Ser Ile Phe Arg Asp Lys Thr Val Ala Glu Leu
 115 120 125

Gly Cys Gly Asn Gly Trp Ile Ser Ile Ala Leu Ala Glu Lys Trp Cys
 130 135 140

Pro Ser Lys Val Tyr Gly Leu Asp Ile Asn Pro Arg Pro Ile Lys Ile
 145 150 155 160

Ala Trp Ile Asn Leu Tyr Leu Asn Ala Leu Asp Asp Asp Gly Leu Pro
 165 170 175

Ile Tyr Asp Ala Glu Gly Lys Thr Leu Leu Asp Arg Val Glu Phe Tyr
 180 185 190

Glu Ser Asp Leu Leu Ser Tyr Cys Arg Asp Asn Lys Ile Glu Leu Asp
 195 200 205

Arg Ile Val Gly Cys Ile Pro Gln Ile Leu Asn Pro Asn Pro Glu Ala
 210 215 220

Met Ser Lys Ile Val Thr Glu Asn Ser Ser Glu Glu Phe Leu Tyr Ser
 225 230 235 240

Leu Ser Asn Tyr Cys Ala Leu Gln Gly Phe Val Glu Asp Gln Phe Gly
 245 250 255

Leu Gly Leu Ile Ala Arg Ala Val Glu Glu Gly Ile Ser Val Ile Lys
 Page 38

260
 Pro Ser Gly Leu Met Val Phe Asn Met Gly Gly Arg Pro Gly Gln Gly
 275 280 285
 Val Cys Glu Arg Leu Phe Leu Arg Arg Gly Phe Arg Ile Asn Lys Leu
 290 295 300
 Trp Gln Thr Lys Ile Met Gln Ala Ala Asp Thr Asp Ile Ser Ala Leu
 305 310 315 320
 Val Glu Ile Glu Lys Asn Ser Arg His Arg Phe Glu Phe Phe Met Asp
 325 330 335
 Leu Val Gly Asp Gln Pro Val Cys Ala Arg Thr Ala Trp Ala Tyr Met
 340 345 350
 Lys Ser Gly Gly Arg Ile Ser His Ala Leu Ser Val Tyr Ser Cys Gln
 355 360 365
 Leu Arg Gln Pro Asn Gln Val Lys Lys Ile Phe Glu Phe Leu Lys Asp
 370 375 380
 Gly Phe His Glu Val Ser Ser Ser Leu Asp Leu Ser Phe Asp Asp Asp
 385 390 395 400
 Ser Val Ala Asp Glu Lys Ile Pro Phe Leu Ala Tyr Leu Ala Ser Phe
 405 410 415
 Leu Gln Glu Asn Lys Ser Asn Pro Cys Glu Pro Pro Ala Gly Cys Leu
 420 425 430
 Asn Phe Arg Asn Leu Val Ala Gly Phe Met Lys Ser Tyr His His Ile
 435 440 445
 Pro Leu Thr Pro Asp Asn Val Val Val Phe Pro Ser Arg Ala Val Ala
 450 455 460
 Ile Glu Asn Ala Leu Arg Leu Phe Ser Pro Gly Leu Ala Ile Val Asp
 465 470 475 480
 Glu His Leu Thr Arg His Leu Pro Lys Gln Trp Leu Thr Ser Leu Ala
 485 490 495
 Ile Glu Glu Ser Asn His Ala Lys Asp Thr Val Thr Val Ile Glu Ala
 500 505 510
 Pro Arg Gln Ser Asp Leu Leu Ile Glu Leu Ile Arg Lys Leu Lys Pro
 515 520 525
 Gln Val Val Val Thr Gly Met Ala Gln Phe Glu Ala Ile Thr Ser Ala

530

535

540

Ala Phe Val Asn Leu Leu Ser Val Thr Lys Asp Val Gly Ser Arg Leu
 545 550 555 560

Leu Leu Asp Ile Ser Glu His Leu Glu Leu Ser Ser Leu Pro Ser Ser
 565 570 575

Asn Gly Val Leu Lys Tyr Leu Ala Gly Lys Thr Leu Pro Ser His Ala
 580 585 590

Ala Ile Leu Cys Gly Leu Val Lys Asn Gln Val Tyr Ser Asp Leu Glu
 595 600 605

Val Ala Phe Ala Ile Ser Glu Asp Pro Thr Val Tyr Lys Ala Leu Ser
 610 615 620

Gln Thr Ile Glu Leu Leu Glu Gly His Thr Ser Val Ile Ser Gln His
 625 630 635 640

Tyr Tyr Gly Cys Leu Phe His Glu Leu Leu Ala Phe Gln Ile Gly Asp
 645 650 655

Arg His Pro Gln Gln Glu Arg Glu Pro Ala Glu Val Ile Ser Lys Glu
 660 665 670

Met Ile Gly Phe Ser Ser Ser Ala Met Ser Thr Leu Glu Gly Ala Glu
 675 680 685

Phe Phe Val Pro Gly Ser Met Glu Ser Gly Val Ile His Met Asp Leu
 690 695 700

Asp Arg Ser Phe Leu Pro Val Pro Ser Ala Val Asn Ala Ser Ile Phe
 705 710 715 720

Glu Ser Phe Val Arg Gln Asn Ile Thr Asp Ser Glu Thr Asp Val Arg
 725 730 735

Ser Ser Ile Gln Gln Leu Val Lys Asp Ser Tyr Gly Phe Ser Ala Gly
 740 745 750

Gly Ala Ser Glu Ile Ile Tyr Gly Asn Thr Cys Leu Ala Leu Phe Asn
 755 760 765

Lys Leu Val Leu Cys Cys Met Gln Glu Gln Gly Thr Leu Leu Phe Pro
 770 775 780

Leu Gly Thr Asn Gly His Tyr Val Asn Ala Ala Lys Phe Val Asn Ala
 785 790 795 800

Thr Thr Leu Thr Ile Pro Thr Lys Ala Asp Ser Gly Phe Lys Ile Glu
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805

810

815

Pro Ser Ala Leu Ala Asp Thr Leu Glu Lys Val Ser Gln Pro Trp Val
820 825 830

Tyr Ile Ser Gly Pro Thr Ile Asn Pro Thr Gly Phe Leu Tyr Ser Asp
835 840 845

Asp Asp Ile Ala Glu Leu Leu Ser Val Cys Ala Thr Tyr Gly Ala Arg
850 855 860

Val Val Ile Asp Thr Ser Ser Ser Gly Leu Glu Phe Gln Ala Thr Gly
865 870 875 880

Cys Ser Gln Trp Asn Leu Glu Arg Cys Leu Ser Asn Val Lys Ser Ser
885 890 895

Lys Pro Ser Phe Ser Val Val Leu Leu Gly Glu Leu Ser Phe Glu Leu
900 905 910

Thr Thr Ala Gly Leu Asp Phe Gly Phe Leu Ile Met Ser Asp Ser Ser
915 920 925

Leu Val Asp Thr Phe Tyr Ser Phe Pro Ser Leu Ser Arg Pro His Ser
930 935 940

Thr Leu Lys Tyr Thr Phe Arg Lys Leu Leu Gly Leu Lys Asn Gln Lys
945 950 955 960

Asp Gln His Phe Ser Asp Leu Ile Leu Glu Gln Lys Glu Thr Leu Lys
965 970 975

Asn Arg Ala Asp Gln Leu Ile Lys Met Leu Glu Ser Cys Gly Trp Asp
980 985 990

Ala Val Gly Cys His Gly Gly Ile Ser Met Leu Ala Lys Pro Thr Ala
995 1000 1005

Tyr Ile Gly Lys Ser Leu Lys Val Asp Gly Phe Glu Gly Lys Leu
1010 1015 1020

Asp Ser His Asn Met Arg Glu Ala Leu Leu Arg Ser Thr Gly Leu
1025 1030 1035

Cys Ile Ser Ser Ser Gly Trp Thr Gly Val Pro Asp Tyr Cys Arg
1040 1045 1050

Phe Ser Phe Ala Leu Glu Ser Gly Asp Phe Asp Arg Ala Met Glu
1055 1060 1065

Cys Ile Ala Arg Phe Arg Glu Leu Val Leu Gly Gly Gly Ala Lys
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1070

1075

pctdk2011050186-seq1
1080Val Asn Gly Ser Asn
1085

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 <211> 186
 <212> PRT
 <213> Barley, Mutant 14018

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20 25 30Leu Glu Ala Pro Ala Thr Arg Ala Glu Ala Arg Arg Leu Leu Gly Ala
35 40 45Val Arg Arg Arg Phe Ala Ala Gly Gly Pro Ala Ala Gly Leu Glu Cys
50 55 60Phe Arg Thr Phe His Phe Arg Ile His Asp Val Val Leu Asp Pro His
65 70 75 80Leu Gln Gly Phe Gln Gln Arg Lys Lys Leu Thr Met Met Glu Ile Pro
85 90 95Ser Ile Phe Ile Pro Glu Asp Trp Ser Phe Thr Phe Tyr Glu Gly Leu
100 105 110Asn Arg His Pro Asp Ser Ile Phe Arg Asp Lys Thr Val Ala Glu Leu
115 120 125Gly Cys Gly Asn Gly Trp Ile Ser Ile Ala Leu Ala Glu Lys Trp Cys
130 135 140Pro Ser Lys Ile Gly Thr Ser Cys Ser Val Asp Ile Tyr Leu Ile Ser
145 150 155 160Phe Val Ala Asn Met Gly Pro Ala Glu Val Arg His Leu Leu Arg Leu
165 170 175Leu Tyr Met Lys Leu Leu Gly Val Cys Gln
180 185

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Ala Ser Gly Asp Ala Ala Tyr Gly Ala Ala Lys Ala Val Leu Glu Arg
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Leu Glu Ala Pro Ala Thr Arg Ala Glu Ala Arg Arg Leu Leu Gly Ala
35 40 45

Val Arg Arg Arg Phe Ala Ala Gly Gly Pro Ala Ala Gly Leu Glu Cys
50 55 60

Phe Arg Thr Phe His Phe Arg Ile His Asp Val Val Leu Asp Pro His
65 70 75 80

Leu Gln Gly Phe Gln Gln Arg Lys Lys Leu Thr Met Met Glu Ile Pro
85 90 95

Ser Ile Phe Ile Pro Glu Asp Trp Ser Phe Thr Phe Tyr Glu Gly Leu
100 105 110

Asn Arg His Pro Asp Ser Ile Phe Arg Asp Lys Thr Val Ala Glu Leu
115 120 125

Gly Cys Gly Asn Gly Trp Ile Ser Ile Ala Leu Ala Glu Lys Trp Cys
130 135 140

Pro Ser Lys Ile Gly Thr Ser Cys Ser Val Asp Ile Tyr Leu Ile Ser
145 150 155 160

Phe Val Ala Asn Met Gly Pro Ala Glu Val Arg His Leu Leu Arg Phe
165 170 175

Met Val Trp Ile
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<213> Barley, Mutant 14018

<400> 17

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Ala Ser Gly Asp Ala Ala Tyr Gly Ala Ala Lys Ala Val Leu Glu Arg
20 25 30

Leu Glu Ala Pro Ala Thr Arg Ala Glu Ala Arg Arg Leu Leu Gly Ala
35 40 45

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Val Arg Arg Arg Phe Ala Ala Gly Gly Pro Ala Ala Gly Leu Glu Cys
50 55 60

Phe Arg Thr Phe His Phe Arg Ile His Asp Val Val Leu Asp Pro His
65 70 75 80

Leu Gln Gly Phe Gln Gln Arg Lys Lys Leu Thr Met Met Glu Ile Pro
85 90 95

Ser Ile Phe Ile Pro Glu Asp Trp Ser Phe Thr Phe Tyr Glu Gly Leu
100 105 110

Asn Arg His Pro Asp Ser Ile Phe Arg Asp Lys Thr Val Ala Glu Leu
115 120 125

Gly Cys Gly Asn Gly Leu Trp Ser Gly Tyr Lys Pro Lys Ser Tyr Gln
130 135 140

Asp Cys Met Asp Lys Pro Leu Leu Glu Cys Thr Arg Arg Arg Trp Ser
145 150 155 160

Pro Asn Leu