**Table S1:** Effect of γ-rays on various agro-morphological traits in M2 generation of soft textured wheat variety HPW 89

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Treatment** | **DTF (days)** | **PH (cm)** | **NOT (no.)** | **PL (cm)** |
| **Range** | **Mean ± S.E.** | **Range** | **Mean ± S.E.** | **Range** | **Mean ± S.E.** | **Range** | **Mean ± S.E.** |
| **HPW 89** | 128.0-132.0 | 130.40a ± 1.33 | 97.2-102.4 | 98.86a ± 1.20 | 4.0-5.0 | 4.80ab ± 0.66 | 9.1-12.4 | 10.60a ± 0.23 |
| **250 Gy** | 124.0-134.0 | 127.80b ± 2.18 | 82.3-108.5 | 89.74b ± 1.54 | 3.0-6.0 | 5.20a ± 0.80 | 7.5-14.1 | 9.28b ± 0.68 |
| **300 Gy** | 121.0-133.0 | 128.60b ± 1.76 | 79.5-100.4 | 88.04b ± 1.16 | 3.0-6.0 | 5.20a ± 0.76 | 7.1-13.7 | 8.98b ± 0.45 |
| **350 Gy** | 122.0-132.0 | 129.20ab ± 1.64 | 78.3-98.2 | 87.30b ± 1.14 | 3.0-5.0 | 4.40b ± 0.63 | 6.2-10.3 | 8.88b ± 0.72 |
| **CV (%)** | 0.80 | 6.28 | 13.50 | 11.13 |
| **LSD** | 1.38 | 3.17 | 0.65 | 1.65 |
| **Treatment** | **SL (cm)** | **GPS (no.)** | **GFP (days)** | **DTM (days)** |
| **Range** | **Mean ± S.E.** | **Range** | **Mean ± S.E.** | **Range** | **Mean ± S.E.** | **Range** | **Mean ± S.E.** |
| **HPW 89** | 9.0-10.6 | 9.30c ± 0.24 | 39.0-49.0 | 46.20b ± 0.24 | 42.0-47.0 | 44.40a ± 0.18 | 169.0-176.0 | 172.80a ± 0.22 |
| **250 Gy** | 7.8-14.8 | 10.02a ± 0.26 | 32.0-55.0 | 49.60a ± 0.56 | 40.0-50.0 | 42.20b ± 0.23 | 162.0-175.0 | 170.00b ± 0.35 |
| **300 Gy** | 7.5-13.9 | 10.00a ± 0.39 | 34.0-56.0 | 49.00a ± 0.73 | 35.0-48.0 | 42.00b ± 0.54 | 161.0-176.0 | 170.60b ± 0.42 |
| **350 Gy** | 6.3-12.5 | 9.62b ± 0.30 | 22.0-55.0 | 48.60a ± 0.62 | 36.0-49.0 | 40.00c ± 0.39 | 162.0-171.0 | 169.20b ± 0.37 |
| **CV (%)** | 13.35 | 8.29 | 5.17 | 1.62 |
| **LSD** | 0.65 | 2.54 | 2.25 | 2.45 |
| **Treatment** | **BY (g)** | **HI (%)** | **TGW (g)** | **GY (g)** |
| **Range** | **Mean ± S.E.** | **Range** | **Mean ± S.E.** | **Range** | **Mean ± S.E.** | **Range** | **Mean ± S.E.** |
| **HPW 89** | 16.8-18.9 | 18.04ab ± 1.20 | 45.7-51.5 | 48.91b ± 0.52 | 45.7-51.3 | 48.57ab ± 0.22 | 7.9-9.8 | 8.72ab ± 0.34 |
| **250 Gy** | 12.1-22.5 | 18.70a ± 1.56 | 47.5-51.9 | 49.72ab ± 0.56 | 41.1-52.7 | 49.30a ± 0.39 | 7.3-11.8 | 9.65a ± 0.55 |
| **300 Gy** | 12.6-21.8 | 17.66ab ± 1.51 | 40.7-52.7 | 49.98ab ± 0.72 | 38.9-51.9 | 49.54a ± 0.35 | 7.1-11.3 | 9.12ab ± 0.48 |
| **350 Gy** | 10.8-20.5 | 16.56b ± 1.38 | 41.6-52.8 | 50.76a ± 0.68 | 30.2-50.8 | 46.72b ± 0.31 | 4.5-10.8 | 8.40b ± 0.22 |
| **CV (%)** | 7.03 | 8.87 | 3.88 | 9.94 |
| **LSD** | 1.34 | 1.13 | 1.92 | 0.56 |
| *Different letters indicate statistical significance (DMRT test with p ≤0.05)**DTF: Days to 50% flowering, PH: Plant height, NOT: Tillers per plant, PL: Peduncle length, SL: Spike length, GPS: Grains per spike, GFP: Grain filling period, DTM: Days to 75% maturity, BY: Biological yield per plant, HI: Harvest index, TGW: 1000 grain weight & GY: Grain yield per plant* |

**Table S2:** Effect of γ-rays on various agro-morphological traits in M3 generation of soft textured wheat variety HPW 89

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Treatment** | **DTF (days)** | **PH (cm)** | **NOT (no.)** | **PL (cm)** |
| **Range** | **Mean ± S.E.** | **Range** | **Mean ± S.E.** | **Range** | **Mean ± S.E.** | **Range** | **Mean ± S.E.** |
| **HPW 89** | 98.0-104.0 | 101.20a ± 0.43 | 82.5-97.2 | 90.58a ± 0.90 | 4.0-5.0 | 4.20ab ± 0.32 | 7.1-9.8 | 8.58a ± 0.42 |
| **250 Gy** | 96.0-105.0 | 100.80ab ± 0.39 | 75.7-103.2 | 85.10b ± 1.32 | 3.0-5.0 | 4.48a ± 0.29 | 5.7-10.5 | 8.00b ± 0.38 |
| **300 Gy** | 95.0-105.0 | 99.4b ± 0.56 | 78.6-100.6 | 88.30ab ± 1.08 | 3.0-5.0 | 4.32ab ± 0.25 | 5.6-9.9 | 7.60b ± 0.26 |
| **350 Gy** | 92.0-104.0 | 100.0ab ± 0.71 | 79.2-99.7 | 89.14ab ± 1.23 | 3.0-5.0 | 4.20ab ± 0.46 | 5.1-9.5 | 7.52b ± 0.35 |
| **CV (%)** | 1.29 | 7.54 | 15.62 | 12.87 |
| **LSD** | 1.54 | 2.78 | 0.32 | 0.86 |
| **Treatment** | **SL (cm)** | **GPS (no.)** | **GFP (days)** | **DTM (days)** |
| **Range** | **Mean ± S.E.** | **Range** | **Mean ± S.E.** | **Range** | **Mean ± S.E.** | **Range** | **Mean ± S.E.** |
| **HPW 89** | 7.5-9.8 | 8.56b ± 0.31 | 28.0-41.0 | 34.60b ± 0.39 | 35.0-43.0 | 40.00a ± 0.23 | 137.0-143.0 | 141.20a ± 0.12 |
| **250 Gy** | 7.1-11.5 | 8.96a ± 0.28 | 33.0-43.0 | 38.40a ± 0.52 | 32.0-45.0 | 38.00b ± 0.37 | 133.0-145.0 | 138.80b ± 0.32 |
| **300 Gy** | 7.6-10.8 | 8.58b ± 0.51 | 29.0-45.0 | 34.60b ± 0.48 | 35.0-44.0 | 39.20ab ± 0.53 | 131.0-144.0 | 138.60b ± 0.18 |
| **350 Gy** | 7.8-9.7 | 8.52b ± 0.44 | 30.0-44.0 | 37.40ab ± 0.62 | 33.0-42.0 | 37.60b ± 0.49 | 132.0-141.0 | 137.60b ± 0.21 |
| **CV (%)** | 14.89 | 11.30 | 7.68 | 1.59 |
| **LSD** | 0.29 | 3.08 | 1.68 | 1.83 |
| **Treatment** | **BY (g)** | **HI (%)** | **TGW (g)** | **GY (g)** |
| **Range** | **Mean ± S.E.** | **Range** | **Mean ± S.E.** | **Range** | **Mean ± S.E.** | **Range** | **Mean ± S.E.** |
| **HPW 89** | 15.2-17.7 | 16.42ab ± 1.17 | 44.5-52.5 | 48.44ab ± 0.62 | 38.1-45.7 | 40.80ab ± 0.31 | 8.5-9.4 | 8.86b ± 0.38 |
| **250 Gy** | 13.2-20.8 | 17.00ab ± 0.96 | 41.7-53.7 | 49.62a ± 0.76 | 33.2-47.2 | 41.02a ± 0.29 | 7.2-11.5 | 9.40a ± 0.53 |
| **300 Gy** | 14.7-19.7 | 17.60a ± 1.36 | 44.5-51.2 | 48.26b ± 0.45 | 35.8-48.9 | 40.40ab ± 0.38 | 7.5-10.6 | 9.30ab ± 0.49 |
| **350 Gy** | 12.4-19.5 | 16.88ab ± 1.52 | 42.6-52.9 | 48.29b ± 0.78 | 32.1-49.5 | 40.68ab ± 0.42 | 7.1-9.8 | 9.10ab ± 0.68 |
| **CV (%)** | 9.85 | 10.28 | 5.66 | 11.63 |
| **LSD** | 1.17 | 1.05 | 0.86 | 0.48 |
| *Different letters indicate statistical significance (DMRT test with p ≤0.05)**DTF: Days to 50% flowering, PH: Plant height, NOT: Tillers per plant, PL: Peduncle length, SL: Spike length, GPS: Grains per spike, GFP: Grain filling period, DTM: Days to 75% maturity, BY: Biological yield per plant, HI: Harvest index, TGW: 1000 grain weight & GY: Grain yield per plant* |

**Table S3:** Grain hardness classification of 293 mutants of wheat variety HPW 89 along with checks

|  |  |  |  |
| --- | --- | --- | --- |
| **Class** | **SKCS Score** | **No. of Mutants** | **Mutant No. + Check(s)** |
| **Very soft** | **1-10** | **17+1 (C)** | Su-M-34, Su-M-35, Su-M-72, Su-M-76, Su-M-78, Su-M-83, Su-M-88, Su-M-90, Su-M-93, Su-M-95, Su-M-97, Su-M-98, Su-M-99, Su-M-100, Su-M-130, Su-M-217, Su-M-283 & HPW 89 |
| **Soft** | **10-20** | **61+0 (C)** | Su-M-11, Su-M-12, Su-M-14, Su-M-25, Su-M-26, Su-M-32, Su-M-33, Su-M-36, Su-M-38, Su-M-39, Su-M-40, Su-M-41, Su-M-42, Su-M-43, Su-M-45, Su-M-46, Su-M-47, Su-M-49, Su-M-52, Su-M-55, Su-M-60, Su-M-63, Su-M-64, Su-M-69, Su-M-70, Su-M-73, Su-M-74, Su-M-77, Su-M-80, Su-M-81, Su-M-85, Su-M-86, Su-M-89, Su-M-92, Su-M-94, Su-M-96, Su-M-102, Su-M-120, Su-M-123, Su-M-127, Su-M-137, Su-M-138, Su-M-149, Su-M-152, Su-M-158, Su-M-172, Su-M-202, Su-M-204, Su-M-211, Su-M-220, Su-M-221, Su-M-223, Su-M-224, Su-M-225, Su-M-226, Su-M-248, Su-M-260, Su-M-264, Su-M-266, Su-M-273, & Su-M-285 |
| **20-30** | **107+1 (C)** | Su-M-15, Su-M-16, Su-M-21, Su-M-22, Su-M-27, Su-M-28, Su-M-29, Su-M-31, Su-M-37, Su-M-44, Su-M-48, Su-M-50, Su-M-51, Su-M-53, Su-M-54, Su-M-57, Su-M-61, Su-M-67, Su-M-71, Su-M-75, Su-M-79, Su-M-84, Su-M-87, Su-M-91, Su-M-101, Su-M-107, Su-M-111, Su-M-119, Su-M-121, Su-M-125, Su-M-128, Su-M-129, Su-M-131, Su-M-132, Su-M-134, Su-M-135, Su-M-139, Su-M-140, Su-M-141, Su-M-144, Su-M-146, Su-M-147, Su-M-150, Su-M-151, Su-M-156, Su-M-157, Su-M-159, Su-M-160, Su-M-162, Su-M-163, Su-M-166, Su-M-168, Su-M-169, Su-M-170, Su-M-171, Su-M-173, Su-M-176, Su-M-177, Su-M-186, Su-M-187, Su-M-188, Su-M-189, Su-M-191, Su-M-197, Su-M-198, Su-M-200, Su-M-201, Su-M-203, Su-M-205, Su-M-206, Su-M-207, Su-M-208, Su-M-214, Su-M-218, Su-M-219, Su-M-227, Su-M-229, Su-M-230, Su-M-231, Su-M-232, Su-M-233, Su-M-235, Su-M-236, Su-M-239, Su-M-244, Su-M-246, Su-M-247, Su-M-249, Su-M-252, Su-M-255, Su-M-256, Su-M-257, Su-M-259, Su-M-261, Su-M-272, Su-M-275, Su-M-276, Su-M-277, Su-M-278, Su-M-282, Su-M-286, Su-M-287, Su-M-288, Su-M-289, Su-M-291, Su-M-292, Su-M-293 & HS 490 |
| **Semi-hard** | **30-40** | **99+0 (C)** | Su-M-1, Su-M-3, Su-M-5, Su-M-6, Su-M-7, Su-M-8, Su-M-9, Su-M-10, Su-M-13, Su-M-17, Su-M-18, Su-M-19, Su-M-20, Su-M-23, Su-M-24, Su-M-30, Su-M-56, Su-M-58, Su-M-59, Su-M-65, Su-M-66, Su-M-68, Su-M-82, Su-M-103, Su-M-104, Su-M-105, Su-M-108, Su-M-109, Su-M-110, Su-M-113, Su-M-114, Su-M-115, Su-M-116, Su-M-117, Su-M-118, Su-M-122, Su-M-124, Su-M-126, Su-M-133, Su-M-136, Su-M-142, Su-M-143, Su-M-145, Su-M-148, Su-M-153, Su-M-154, Su-M-155, Su-M-164, Su-M-165, Su-M-167, Su-M-174, Su-M-175, Su-M-178, Su-M-179, Su-M-180, Su-M-181, Su-M-182, Su-M-183, Su-M-184, Su-M-185, Su-M-190, Su-M-192, Su-M-193, Su-M-194, Su-M-196, Su-M-199, Su-M-209, Su-M-210, Su-M-212, Su-M-213, Su-M-215, Su-M-216, Su-M-228, Su-M-234, Su-M-237, Su-M-238, Su-M-240, Su-M-242, Su-M-243, Su-M-245, Su-M-250, Su-M-251, Su-M-253, Su-M-254, Su-M-258, Su-M-262, Su-M-263, Su-M-265, Su-M-267, Su-M-268, Su-M-269, Su-M-270, Su-M-271, Su-M-274, Su-M-279, Su-M-280, Su-M-281, Su-M-284 and Su-M-290 |
| **40-50** | **8+0 (C)** | Su-M-2, Su-M-4, Su-M-62, Su-M-106, Su-M-112, Su-M-161, Su-M-222 and Su-M-241 |
| **50-60** | **1+3 (C)** | Su-M-195, HPW 349, HS 542 and HS 562 |
| **60-70** | **0+1 (C)** | HS 507 |
| **Hard** | **70-80** | **-** | - |
| **80-90** | **-** | - |
| **Very hard** | **90-100** | **-** | - |
| **Total** |  | **293+6 (C)** |  |
| *SKCS: Single Kernel Characterization System, C: Check* |

**Table S4.1:** List of promising mutants of wheat variety HPW 89 screened in the M3 generation

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Mutant(s)/ Check(s)** | **DTF** | **PH** | **NOT** | **PL** | **SL** | **GPS** |
| Su-M-2 (250 Gy) | 97.68 ± 1.51 | 85.44 ± 1.37 | 4.42 ± 0.29 | 8.41 ± 0.25 | 9.18 ± 0.52 | 41.95 ± 0.76 |
| Su-M-4 (250 Gy) | 99.81 ± 1.28 | 94.94 ± 1.95 | 4.22 ± 0.38 | 9.91 ± 0.40 | 8.26 ± 0.36 | 39.70 ± 0.51 |
| Su-M-62 (250 Gy)  | 101.74 ± 1.87 | 86.57 ± 2.07 | 3.85 ± 0.21 | 7.19 ± 0.21 | 7.91 ± 0.51 | 35.28 ± 0.63 |
| Su-M-106 (250 Gy) | 102.72 ± 1.66 | 82.86 ± 0.99 | 3.62 ± 0.22 | 8.67 ± 0.21 | 8.67 ± 0.39 | 36.62 ± 0.57 |
| Su-M-112 (250 Gy) | 100.72 ± 2.52 | 79.82 ± 1.66 | 3.68 ± 0.30 | 7.98 ± 0.36 | 7.84 ± 0.56 | 35.79 ± 0.42 |
| Su-M-161 (250 Gy) | 100.51 ± 1.39 | 92.11 ± 1.26 | 4.20 ± 0.15 | 8.53 ± 0.22 | 9.26 ± 0.28 | 38.60 ± 1.04 |
| Su-M-222 (250 Gy) | 97.89 ± 2.51 | 102.61 ± 0.68 | 4.68 ± 0.27 | 8.27 ± 0.36 | 10.87 ± 0.50 | 42.10 ± 0.74 |
| Su-M-241 (250 Gy) | 102.08 ± 1.72 | 94.27 ± 1.18 | 4.12 ± 0.18 | 9.20 ± 0.30 | 8.59 ± 0.44 | 35.50 ± 0.60 |
| Su-M-195 (300 Gy) | 102.33 ± 1.26 | 87.77 ± 1.74 | 3.98 ± 0.27 | 9.84 ± 0.49 | 9.98 ± 0.30 | 39.89 ± 0.52 |
| HS 542 (C) | 95.33 ± 0.57 | 94.48 ± 1.25 | 3.87 ± 0.17 | 9.68 ± 0.14 | 9.62 ± 0.16 | 39.15 ± 0.42 |
| HS 562 (C) | 99.50 ± 1.11 | 92.60 ± 1.22 | 4.21 ± 0.12 | 9.72 ± 0.21 | 7.88 ± 0.37 | 32.80 ± 0.58 |
| HPW 349 (C) | 101.00 ± 0.62 | 85.60 ± 1.56 | 3.82 ± 0.16 | 9.27 ± 0.25 | 7.96 ± 0.31 | 36.65 ± 0.45 |
| HS 507 (C) | 98.33 ± 0.71 | 86.73 ± 1.62 | 4.86 ± 0.16 | 9.20 ± 0.39 | 9.52 ± 0.22 | 37.87 ± 0.39 |
| HS 490 (C) | 95.67 ± 0.48 | 91.07 ± 1.57 | 3.99 ± 0.27 | 8.98 ± 0.35 | 9.55 ± 0.32 | 40.25 ± 0.19 |
| HPW 89 (C/P) | 101.00 ± 0.61 | 92.69 ± 0.53 | 4.26 ± 0.11 | 9.15 ± 0.29 | 8.95 ± 0.45 | 39.52 ± 0.18 |
| *C: Check; P: Parent; DTF: Days to 50% flowering, PH: Plant height, NOT: Tillers per plant, PL: Peduncle length, SL: Spike length, GPS: Grains per spike, GFP: Grain filling period, (250-350 Gy): Mutant derived from irradiated population* |

**Table S4.2:** List of promising mutants of wheat variety HPW 89 screened in the M3 generation

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Mutant(s)/ Check(s)** | **DTM** | **BY** | **HI** | **TGW** | **GY** | **GH** |
| Su-M-2 (250 Gy) | 138.06 ± 2.46 | 19.63 ± 0.31 | 45.26 ± 0.27 | 43.29 ± 0.48 | 10.66 ± 0.16 | 41.17 ± 0.39 |
| Su-M-4 (250 Gy) | 141.31 ± 2.06 | 17.82 ± 0.40 | 46.01 ± 0.31 | 40.63 ± 0.97 | 10.22 ± 0.09 | 43.44 ± 0.93 |
| Su-M-62 (250 Gy)  | 141.39 ± 2.72 | 16.91 ± 0.12 | 49.18 ± 0.05 | 37.78 ± 0.62 | 9.39 ± 0.19 | 43.31 ± 0.68 |
| Su-M-106 (250 Gy) | 141.31 ± 2.94 | 15.16 ± 0.02 | 49.01 ± 0.51 | 37.65 ± 0.65 | 8.95 ± 0.05 | 42.18 ± 0.24 |
| Su-M-112 (250 Gy) | 142.31 ± 1.41 | 16.97 ± 0.19 | 47.86 ± 1.12 | 35.86 ± 0.02 | 8.62 ± 0.15 | 44.34 ± 0.67 |
| Su-M-161 (250 Gy) | 141.72 ± 1.15 | 19.35 ± 0.33 | 49.13 ± 0.44 | 40.87 ± 0.06 | 10.49 ± 0.25 | 40.81 ± 0.08 |
| Su-M-222 (250 Gy) | 139.47 ± 1.44 | 19.85 ± 0.36 | 49.06 ± 0.71 | 41.98 ± 0.48 | 10.72 ± 0.10 | 49.74 ± 0.87 |
| Su-M-241 (250 Gy) | 141.31 ± 2.35 | 17.25 ± 0.02 | 48.40 ± 0.02 | 39.78 ± 0.71 | 9.88 ± 0.06 | 40.66 ± 0.46 |
| Su-M-195 (300 Gy) | 140.81 ± 2.62 | 17.72 ± 0.10 | 49.15 ± 1.07 | 41.53 ± 0.80 | 9.73 ± 0.19 | 54.90 ± 0.12 |
| HS 542 (C) | 141.50 ± 1.04 | 16.63 ± 0.45 | 46.39 ± 0.34 | 40.88 ± 0.86 | 9.57 ± 0.11 | 53.06 ± 0.83 |
| HS 562 (C) | 140.50 ± 1.15 | 17.02 ± 0.35 | 46.61 ± 0.27 | 42.64 ± 0.53 | 8.40 ± 0.18 | 56.00 ± 0.41 |
| HPW 349 (C) | 145.50 ± 0.71 | 18.53 ± 0.48 | 47.16 ± 0.71 | 39.71 ± 0.63 | 9.21 ± 0.18 | 50.46 ± 1.05 |
| HS 507 (C) | 144.67 ± 1.34 | 18.89 ± 0.36 | 49.41 ± 1.14 | 38.86 ± 0.24 | 9.53 ± 0.20 | 65.31 ± 0.78 |
| HS 490 (C) | 137.33 ± 1.57 | 17.83 ± 0.13 | 45.99 ± 0.36 | 39.57 ± 0.65 | 8.58 ± 0.12 | 21.38 ± 0.35 |
| HPW 89 (C/P) | 139.33 ± 0.91 | 17.25 ± 0.23 | 47.61 ± 0.22 | 40.56 ± 0.30 | 9.22 ± 0.14 | 7.39 ± 0.17 |
| *C: Check; P: Parent; DTM: Days to 75% maturity, BY: Biological yield per plant, HI: Harvest index, TGW: 1000 grain weight & GY: Grain yield per plant; (250-350 Gy): Mutant derived from irradiated population* |